DESY inFORM.

07&08/2011
Newsletter of the
Research Centre DESY

Construction progress at the European XFEL

3600 metres of tunnel completed – topping-out ceremony for the injector complex

by Petra Folkerts

At 3600 metres, the total length of the completed European XFEL tunnel sections now exceeds the distance between the electron source on the DESY-Bahrenfeld site and the scientific instruments that will be located in the future experimental hall in Schenefeld. Construction is not easy, however, because the two tunnel boring machines TULA and AMELI must proceed from one building pit to the next, meaning they must launch and arrive several times.

AMELI, which has been working beneath the Schenefeld site since the beginning of this year, is especially concerned. It is due to realise seven different tunnel sections, the shortest of which is only 141 metres long. As soon as the machine picks up speed after the launch, the tunnel workers must thus slow it down again and prepare its breakthrough into the next reception shaft. But there is more: subsequently, the colossus must either be moved to the opposite side of the shaft or transported back to the building pit of the future experimental hall to be reassembled for the next launch. Both operations take approximately seven weeks each.
AMELI has already passed the "acid test" once, with one towing procedure and one transport back to the experimental hall. It is now constructing its third tunnel section.

AMELI on its way back to its second launch from the building pit of the future experiment hall. Lifting the whole machine out of its reception shaft on 10 April 2011 not only entailed a special crane. Tact was required as well, because AMELI's first reception shaft was also the supply shaft for TULA.

TULA, which powered up half a year earlier, already accomplished its three planned starts. It completed the two long switchyard tunnels XTD1 and XTD2 between the Osdorfer Born and Schenefeld sites at the end of last year. In January 2011, the machine set off from the Osdorfer Born building pit for its two-kilometre-long journey to the injector building on the DESY-Bahrenfeld site. It is due to break through the west wall of this building in a few weeks (at the time of going to press, it had completed almost 1700 metres). TULA will then become obsolete. The machine as such – that is, the front part with the cutterhead – will be disassembled and transported back to the manufacturer. The 62-metre-long backup system will be towed back through the completed tunnel XTL to the building pit XS1 in Osdorf.

In the meantime, the second building consortium has been working hard on

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HAXPES-Workshop at DESY

From 14 to 16 September, the 4th „Hard X-ray photoelectron spectroscopy" workshop will take place at DESY. Photoelectron spectroscopy with hard X-ray beams is a relatively new and rapidly developing technique. Its large probing depth makes it a powerful tool for studies of multi-layered structures or buried nano-structures.

New names for DESY departments

As from now, two DESY groups have new names: BAU for the construction department (formerly ZBAU), and the ZTS security group is descriptively named SAVE (acronym for "Servicezentrum Anlagensicherheit, Vorbeugender Brandschutz, Emergency Service")

DIRECTOR'S CORNER

Dear colleagues,

Meanwhile, regular or so-called „friendly" users are measuring at almost all PETRA III beamlines and obtain first spectacular results. Only recently, it was possible to concentrate X-ray beams to a size of 10 to 80 nanometres – values that are very difficult or impossible to obtain at other sources.

Now we are able to analyse the structure and chemistry of samples at these magnitudes. Recently, DESY and the partner institutions TU Dresden, University of Göttingen, and KIT were granted a new Virtual Institute in this field of research. Moreover, DESY is a strong partner of another Virtual Institute, coordinated by HZB.

DESY is becoming more and more attractive worldwide. Apart from the collaboration with Brazil's LNLS and the participation of Sweden and India at PETRA III, a MoU was signed on occasion of the inauguration of the German-Russian Year of Science for the establishment of the Ioffe Röntgen Institute, which will support scientific cooperation between both states. DESY and the University of Hamburg jointly appointed a very well-known colleague as a senior scientist in the field of nano science, and we hope to welcome him here soon. Furthermore, Professor Wolfgang Eberhard, one of the HZB managing directors for science up to now and one of the most renowned experts in spectroscopy with VUV and soft X-ray radiation, will continue his scientific research in the field of photovoltaics in the environment of DESY and CFEL in the future.

For now, I wish you all the best for a relaxing holiday season.

Yours,
Edgar Weckert

the shell of the underground injector building, which is 100 metres long and seven storeys deep. Construction reached halftime and on 22 June, the consortium celebrated the topping-out ceremony – the first such ceremony for an underground building of the European XFEL facility. The shell of the underground injector complex has reached the surface. The construction work for the huge building, which consists of two shafts and two 20-metre connecting tunnels lying on top of each other, started in May 2010. It is to be handed over to the building owner in spring 2012.

"A topping-out ceremony is normally held to celebrate the completion of the roof structure, and the participants are looking up. Today, we are more or less standing on the roof and looking down 37 metres onto the floor of the second injector shaft," said Helmut Dosch, the chairman of the DESY Board of Directors, in his short address. Standing between the two foremen of the companies Züblin and Aug. Prien, he thanked the construction workers for their dedication in realising the building shell. During their work, they had to master a range of challenges, such as the extremely cold and long past winter or the stable bridge carrying the cables for the energy supply of neighbouring quarters, which lies right across the building pit and blocks the free access of the crane.

In the past months, around 22 500 cubic metres of concrete flowed into the more than one metre thick walls and floors. The workers are now adding the finishing touches – for example installing the doors, stairs and lifts or constructing the partition walls.

INFO

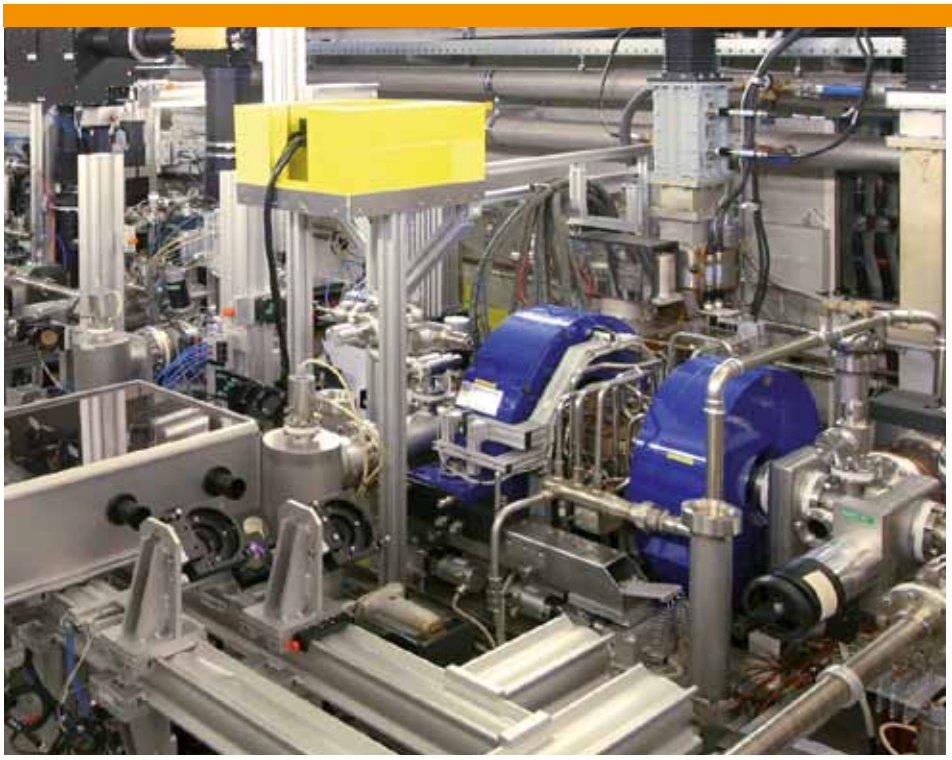
On Saturday 2 July 2011 a subsidence of approximately one cubic metre size has occurred in the garden of a private property located in the Flurstraße. The subsidence sits directly above the tunnel for the European XFEL accelerator, which, at this place, runs about 25 metres below ground level. In this area, the tunnel was built using the shield tunnelling method around four weeks before the subsidence appeared. The subsidence is likely to be related to the tunnel construction, but the exact reasons are still being investigated at the time of press date.

You can find current and further information at www.desy.de.

Accelerator activities in Brandenburg

DESY in Zeuthen is also on the way to the European XFEL

The European XFEL is a unique research facility currently being built at DESY. In just a few years time, it will generate extremely intensive X-ray laser flashes to be used by scientists from all over the world. The construction and stable user operation of a facility with these requirements needs preliminary development work. DESY in Zeuthen is actively participating in this project with its work at the Photo Injector Test Facility PITZ and the modulator test facility MTF.



PITZ – The Photo Injector Test Facility in Zeuthen

A free-electron laser requires an electron beam of high energy and excellent quality. In September 1999, it was decided to build a Photo Injector Test Facility in Zeuthen in order to optimise electron sources for just these standards. The first beam was already generated in January 2002, and until today, four electron sources optimised with PITZ have been delivered to Hamburg. Since 2004, a second source guarantees operation at FLASH. Continuous progress was made during optimisation. This was mainly due to the close cooperation of physicists with the technical groups in Zeuthen and the accelerator sector in Hamburg. In 2009, for the first time, it was shown that with the source operated at PITZ it was not only possible to reach the necessary requirements for the European XFEL, but to even exceed them. In spring 2011, an especially developed technology offered the additional possibility to exactly monitor the RF power, thus guaranteeing stable operation with additionally improved beam quality. Currently, these results obtained at PITZ are the world's best! After the present shut down as from 2012 the test facility will be able to meet the new challenges, with the experience gathered in the past ten years. First to mention is the characterisation of the XFEL start-up source which will be installed in the XFEL injector in 2013 in order to guarantee stable operation. Moreover, new photocathode laser systems and beam diagnosis segments will be tested. Intensive work is invested in the production of ultra-short electron pulses to extend the spectrum of experiments at the European XFEL with new possibilities. PITZ is also involved in the new R&D programme for accelerators of the Helmholtz Association called ARD.

Another element of the European XFEL linear accelerator are the RF-stations generating pulses with enormous power, thus generating the energy to accelerate the electrons. At least 22 of these stations are needed for the European XFEL; the most important components for these will be industrially produced. Therefore, the prototypes delivered by industry must be put to the acid test under European XFEL-like conditions. Accordingly, in June 2005, the directorate approved the build-up of the Modulator Test Facility in Zeuthen. In close collaboration with the responsible colleagues in Hamburg, the Zeuthen colleagues elaborated the specifications for the development of the European XFEL modulator and prepared the tendering for the prototype development. Parallel to this, a new hall was erected, including the infrastructure for European XFEL-like conditions in order to create a test facility for two complete RF systems. After the completion of the tendering, intensive test series were started with the first industrially manufactured modulator in October 2008. These tests resulted in the realisation of improvements to meet the requirements of the European XFEL. In February 2011, the production readiness review was completed successfully with the substantial participation of the Zeuthen colleagues, thus reaching another milestone on the way to the provision of the modulators. The contract recommendation for the production of the European XFEL modulators was prepared and the procurement process is initiated. *(ub)*

JOIN IN.

Open Day 2011

29 October is the date of the fourth “Night of Knowledge” In Hamburg. DESY too, will open its doors and expects thousands of visitors.

What’s special is the fact that DESY combines the “Night of Knowledge” with an “Open Day”, thus extending the opening hours as in previous years from 12 noon to 12 midnight.

Join in! Show our guests your facet of DESY.

All staff members on the DESY campus in Hamburg and of the European XFEL GmbH are cordially invited to contribute to the programme and make this event a successful and fascinating Open Day.

Please register at:
registrierung-tdot.desy.de

Accelerators | Photon Science | Particle Physics

Deutsches Elektronen-Synchrotron
A Research Centre of the Helmholtz Association

WHAT’S ON AT DESY

July

19-23 HAνSE 2011 (http://hanse2011.desy.de)
Hamburg Neutrinos from Supernova Explosions
DESY, Hamburg

20 Public lecture (http://hanse2011.desy.de)
Rätselhafte Supernovae – Den Geheimnissen der größten kosmischen Explosionen auf der Spur
Thomas Janka (MPA, Garching)
DESY, Hamburg, auditorium, 19 h

August

24 Science Café DESY (http://sciencecafe.desy.de)
Hollywoods Filmtricks Part II - Physikalische Irrtümer von Spielberg, Tarantino & Co
Marc Wenskat, DESY Bistro, 17 h

September

5-6 TERASCALE (www.terascale.de/singletop2011)
Single Top Workshop
DESY, Hamburg

14 Science Café DESY (http://sciencecafe.desy.de)
Die Grenzen des Wissens
Ilja Bohnet, DESY Bistro, 17 h

14 Public lecture
Der Alte würfelt nicht – Einsteins Dialog mit Gott
Thomas Naumann
DESY, Hamburg, auditorium, 19 h

14-16 4th HAXPES-Workshop (http://HAXPES2011.desy.de)
Hard X-ray photoelectron spectroscopy
DESY, Hamburg

27-30 Theory
Theory Workshop
DESY, Hamburg

28 Science Café DESY (http://sciencecafe.desy.de)
Anfänge der Wahrscheinlichkeitsrechnung – Ist Glück berechenbar?
Waldemar Tausendfreund, DESY Bistro, 17 h

+++ 29 October: DESYs Open Day and Science Night (DESY, Hamburg) +++
All upcoming events at: www.desy.de/events

Summer conferences ahead

The LHC reaches the annual target – just in time for the upcoming particle physics conferences

Only three months after the first particle beams circled the LHC in 2011, and more than four months before the proton run will be terminated this year, the LHC accelerator team reached its annual target: already now, the LHC has delivered the scheduled data volume for the entire year – 70 billion collisions, or as the experts say: one inverse femtobarn of integrated luminosity. The fact that the scientists already achieved their goal shows how well the LHC is running.

In the CMS Centre, scientists do daily shift work to test the data quality.

It is particularly valuable for the scientists that the LHC data volume has been delivered before the start of the summer conferences – a traditional opportunity to discuss exciting new results. Now the physicists have enough time to include these data into their analyses before these summer conferences will take place. With one inverse femtobarn they hope to find first clues for the Higgs or for supersymmetric particles.

The ATLAS and CMS groups at DESY too, rush at the new data with great enthusiasm. “With the LHC running as good as it does now, we will have enough data by the end of the year to be able to rule out the Higgs – should it not exist – with high probability”, said Klaus Mönig, head of the ATLAS group at DESY.

In spite of the long distance, the DESY groups are always close to their detector at CERN; this is due to the existence of so-called remote monitoring rooms – two in Hamburg and one in Zeuthen. From here, it is possible for example to control the data quality. In Hamburg, the enlarged CMS room was recently moved to its new location in building 1a. The ATLAS monitoring room which is currently located in building 3, will move to building 1c after the end of the renovation.

These remote monitoring rooms will possibly be an attraction at the “Weltmaschine Day” on 23 November. At the second anniversary of the first LHC particle collisions, events will take place at universities and research centres throughout Germany, celebrating the successful run of the LHC. You can find the programme, ranging from science slam to evening lecture, on www.weltmaschine.de. *(gh)*

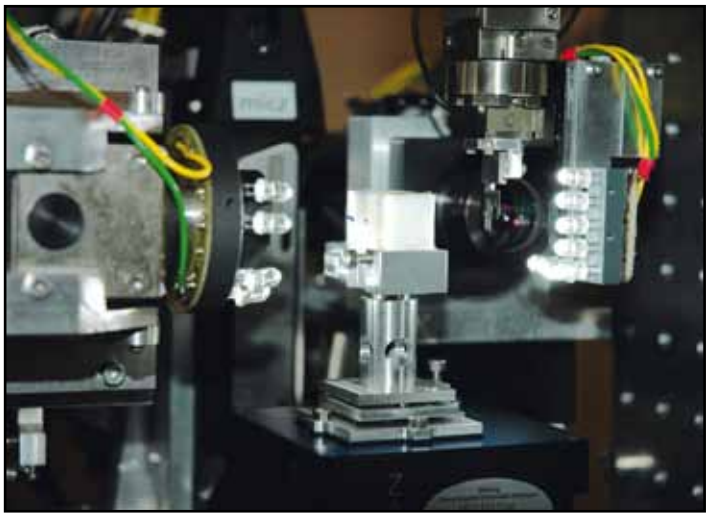
Flying with FLASHgordon

For this year, the kestrel season at DESY is over. The kestrel couple that has been breeding at DESY for many years has raised four chicks. Meanwhile, the fledglings do no longer cling together as they do on this photo. All four have left the nest and took their first flight lessons, not only with their mom DESYrée but also with their daddy who finally got a name too: FLASHgordon.

PETRA III – the nano lamp

A light spot at PETRA III of only 10 nanometres generated

The dimensions of the PETRA III particle bunches are already impressing: just cut a hair five times lengthwise and you will get the height of an electron bunch in the accelerator. Done? Well, now we can get to the smallest size of a light spot recently produced at PETRA III: just cut a hair 5000 times lengthwise.



The world record experiment at the PETRA III beamline

What seems impossible at first sight was achieved at the PETRA III beamline P10 by a team of scientists headed by Tim Salditt from the University of Göttingen. They generated a light spot of only ten nanometres in diameter to illuminate a sample. The advantage of this almost dot-shaped light source: it is possible to take holographic 3D pictures of cells and other small objects.

The Göttingen scientists who are actively working on the development of new measuring methods used a trick to minimise the light source: with a mirror system, they first focussed the X-ray beam to a diameter of 200 nanometres and then coupled it into an X-ray waveguide. In this layer system, consisting of a 35 micrometre thick carbon core encased in molybdenum and germanium, the X-ray beams diffuse like light in fibreglass. The light penetrates two of these layer systems that delimit it vertically and horizontally. This produces the ten-nanometre-beam by the overlapping of different wave parts penetrating the layers. “The small emittance of the PETRA III electron beam is extremely important for these experiments,” said Tim Salditt with regard to the successes of his group. “We are now trying to further improve the light intensity.” *(tz)*

New numbers in the internet

Computers get new IP addresses

by Knut Woller

“Among the participating institutes, DESY is clearly the forerunner in the implementation of IP version 6,” said David Kelsey (RAL), chairman of the HEPiX IPV6 Working Group, at the recent HEPiX workshop held in May at GSI in Darmstadt. Since 20 years, HEPiX takes place twice a year bringing together IT experts from large-scale research laboratories from all over the world for experience exchange, also strongly influencing the IT landscape at DESY .

IPV6 is a new 128-bit-addressing scheme to complement for a while, and after a couple of years completely replace the 32-bit-IP addresses version 4 that has been used for decades. Although already defined at the beginning of the nineties, the overdue broad application takes place only at present, because there are not enough old-scheme addresses to administrate the rapidly growing number of internet-enabled devices. In the Asian region, the last network segments have already been distributed and, by the end of the year, this will also happen in Europe.

In the future, new internet sites or corporate networks will only work with IPV6. To access these, all computers must at first master the new protocol (dual stack operation) as well. Modern operating systems have no problems with that. In many cases, however, the networks themselves – for example the domestic DSL router – are not appropriately configured for this protocol.

The extensive preliminary work at the DESY network has been started a long time ago and, as from May, the first sub-networks at DESY are fully IPV6-enabled.

A global test run took place on 8 June, the World IPV6 Day, when large internet service providers like Google and Facebook started to offer their services with dual stack operation. The fact that this went largely unnoticed, gives hope that the internet transition will be possible without major disturbances.

The HEPiX IPV6 Working Group met on 22 June at CERN. Among other things, there was an agreement to set up an IPV6 infrastructure to be distributed to laboratories on a global scale in order to test Grid software and research applications.

INFO

http://it.desy.de/ipv6

Helmholtz Alliance for Astroparticle Physics

On 1 July new Helmholtz Alliance starts with DESY participation

by Christian Spiering

On 1 July, the Senate of the Helmholtz Association gave their approval for two new Helmholtz Alliances. One of them is the Helmholtz Alliance for Astroparticle Physics, or HAP. In this alliance, scientists from the Karlsruhe Institute of Technology (KIT) and DESY are joining forces with working groups from 15 German universities, three Max Planck Institutes, APC Paris, and KICP Chicago. The five-year funding period starts on 1 July 2011; the funds amount to 10 million euros.

German astroparticle physics has an internationally outstanding position in many areas, with the Helmholtz Centres being active in the fields of cosmic radiation, neutrino astronomy, gamma astronomy, the search for dark matter, and the determination of neutrino mass.

At first, HAP will focus on the evaluation of the results obtained from the current flagship facilities IceCube, Auger, H.E.S.S., and MAGIC which detect high energy neutrinos, cosmic radiation, or gamma rays, and from experiments searching for dark matter. At the same time, we will expand the network of mutually complementary competences and lay special emphasis on young scientists' training. Parallel to this, the above mentioned facilities will be further developed, innovative methods will be tested, and new facilities will be planned: KATRIN for the measurement of neutrino mass, CTA – the new DESY priority project in the field of gamma astronomy; an AUGER follow-up experiment – as well as XENON1t and EURECA – the two experiments for dark matter search weighing tons. The mid-term agenda also includes a huge underground detector to investigate low energy neutrinos and search for proton decay.

HELMHOLTZ ASSOCIATION

Ultrafast data transmission with light

KIT scientists, headed by Professor Jürgen Leuthold, encoded data at a rate of 26 terabit per second on a single laser beam, transmitted them over a distance of 50 kilometres, and successfully decoded the information . With the contents of 700 DVDs in only one second, this is the densest data volume ever transmitted on a laser beam.
The new optoelectric decoding method is based on an initially purely optical calculation at highest data rates in order to break down the high data rate to smaller bit rates which will then be processed electrically. "In the end, the pioneering idea was the optical transformation of the mathematical routines," Leuthold explains. Calculation in the optical range turned out to be not only extremely fast, but also highly energy-efficient, since the energy is only required for the laser and a few process steps .

www.helmholtz.de/hermann

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DESY in the media

More frequently than expected, DESY is visible in the press, radio and television. All staff members do now have the opportunity to track this on the new DESY website at www.desy.de/index_eng →News →"DESY in the Press".

Here you can find the latest 35 hits in the world's online media for DESY, PETRA and the like. Please, bear with us if you find news in Cyrillic or Chinese characters – people there find our basic research fascinating, too.