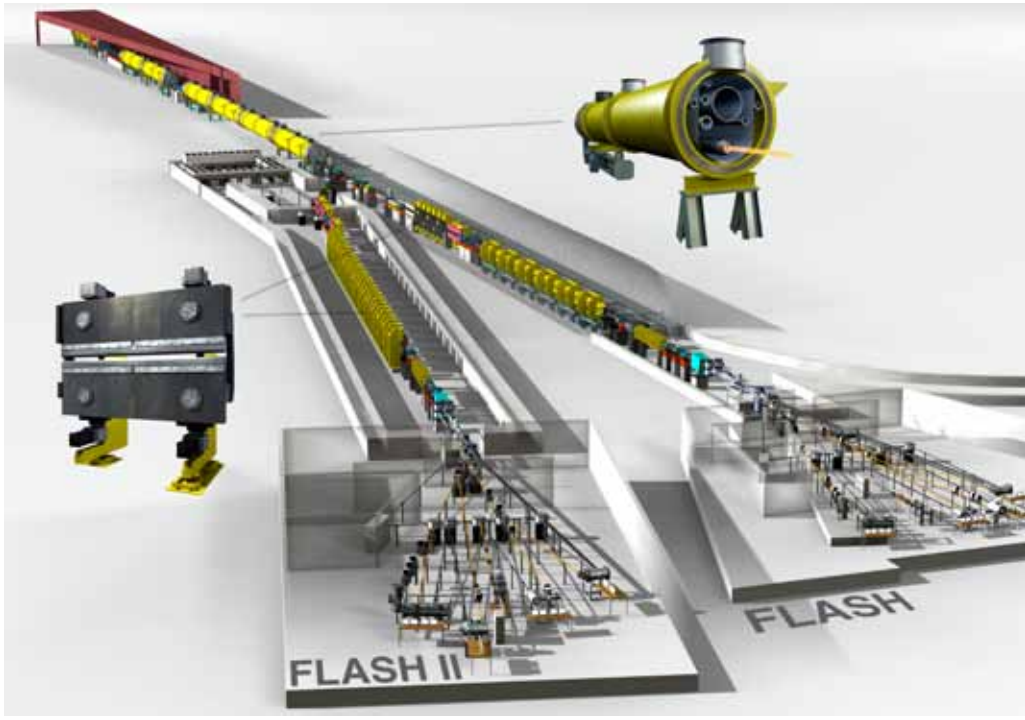
DESY inFORM.

11/2010
Newsletter of the
Research Centre DESY

Next step to FLASH

FLASH produces laser light in the water window for the first time

It happened end of September: FLASH generated laser light for the first time at a wavelength of 4.12 nanometres, thus reaching the so-called water window. In this wavelength region, soft X-ray radiation is able to penetrate several micrometres into water while it is on the other hand highly absorbed by carbon. The result is a great contrast which is very interesting for the investigations of biological samples. Hence, it is possible to produce images of biological objects in small drops or also of cells, with a resolution of 10 nanometres. This light in the water window will be available for users as from next year.



For FLASH II, the existing accelerator will be extended with another light-producing line and another experimental hall.

"We're impressed ourselves that we achieved this," said machine coordinator Siegfried Schreiber. Even after the upgrade of the accelerator (see DESY inForm 07/2010) it was not evident that the accelerator would be able to generate such small wavelengths. "We managed to get the best from each module," said Schreiber. The design of FLASH allows operation at 6.5 nanometres – a value that many times has substantially been undercut by the accelerator team. The lower the wavelength of the laser light, the higher the energy requirements from the accelerator. The installation of an additional accelerator module was a necessary step; however, the extra energy of 200 mega-electronvolts that the new module was to guarantee was calculated not to be enough. 1.25 giga-electronvolts are necessary to reach the water window. Despite of adding the regular supply of energy of one giga-electronvolt from FLASH and the energy of the new module, 50 mega-electronvolts more were still needed to reach the goal. With sensitivity and expertise, the operators in the end managed to get the most out of their machine.

With wavelengths in the water window, FLASH exceeds the designed performance. The planned FLASH upgrade FLASH II, however, should be capable of directly covering this wavelength region, or even smaller wavelengths. The commissioning of this large scale facility is planned for 2010. Construction work for the tunnel and the hall will already start next year. Prior to this, there is a lot of organisation to do: "We have to coordinate this with other groups since we need one shut down of PETRA III and two of FLASH," said Bart Faatz, coordinator of the project. These shut downs are necessary to build the tunnel and to finally connect FLASH and

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Science Café DESY in English

The last Science Café DESY lecture of this year will be a special one: it will be held in English. Biologist Rosemary Wilson from the European Molecular Biology Laboratory (EMBL) will give a talk on "Man or monkey? – The search for our ancestors".

Many schools in Hamburg and in surrounding areas now offer bilingual education, and the Science Café DESY would like to take account of this development. In case this will be a well attended lecture, DESY plans to offer more talks in English from time to time.

DIRECTOR'S CORNER

Dear colleagues,

the Large Hadron Collider LHC sets the pulse of particle physics. Starting with the first high energy collisions end of March, performance was continuously increasing, so that the full-year-target has been surpassed already now. The detectors are working extremely well and reach full capacity in many areas. The global LHC computing grid easily manages the huge flood of data, thus making it possible that the experiments presented first results very soon. Until the end of 2011, the LHC experiments will collect data and perhaps see new physics. Followed by a year of upgrade work, the LHC will force its way far into the Terascale with full energy.

The neutrino telescope IceCube will be completed this winter and measure in the eternal ice with unprecedented resolution from which directions of outer space neutrinos pelt down on our earth.

It does not only fascinate us to draw the secrets from nature, also young people are enthusiastic to do this. In October, we inaugurated the extension of the DESY hands-on laboratory in which now 9000 youths per year have the opportunity to do experiments.

With the collaboration in the large LHC experiments, IceCube, the ILC and a whole series of smaller projects as ALPS and OLYMPUS, particle physics at DESY has a broader spectrum than ever before. I am very happy that there is such a wealth of ideas and research for the improvement of accelerators and experiments. There are even new and interesting ideas about how to use the HERA ring in the future.

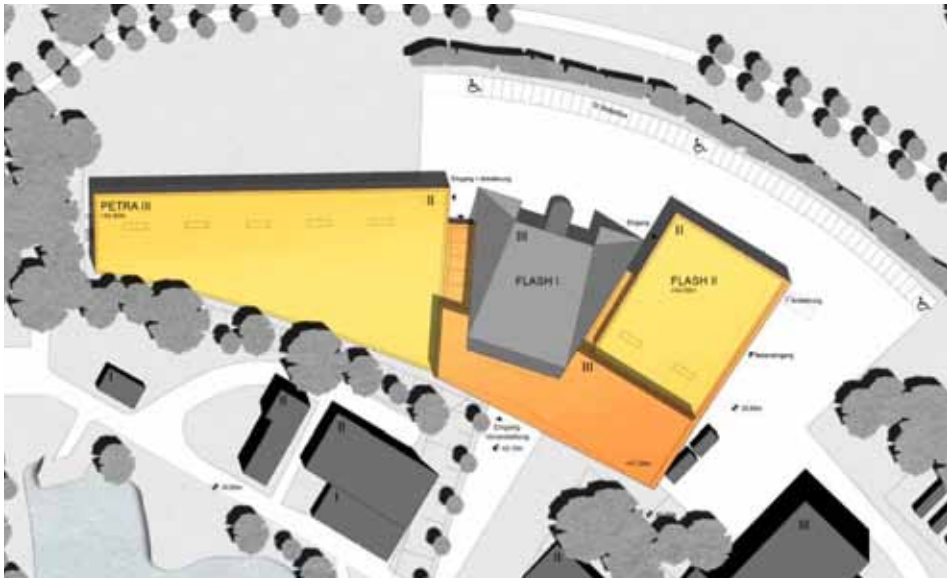
End of October, German particle physicists met in Dortmund to plan the course of particle physics for the coming years. As from next year, the European Particle Physics Roadmap will be renewed, and I strongly believe that Germany and DESY will play a substantial role in this new roadmap.

Yours,
Joachim Mnich

FLASH II because both facilities are operated with the existing accelerator. First tests have already been concluded successfully.

FLASH II will be built directly between FLASH and the PETRA III hall. In order to integrate the new buildings harmonically into the DESY campus, there was an architects' competition from which the best design was chosen. It does not only include the new FLASH II experimental hall with additional six measuring stations, but also the PETRA III North extension and the existing FLASH experimental hall.

Starting in 2014, FLASH will run parallel with two undulator lines and two experimental halls, thus giving more scientists the opportunity to see their samples in a different light. *(gh)*



Both, the FLASH II experimental hall and the planned PETRA III extension will frame the existing FLASH hall.

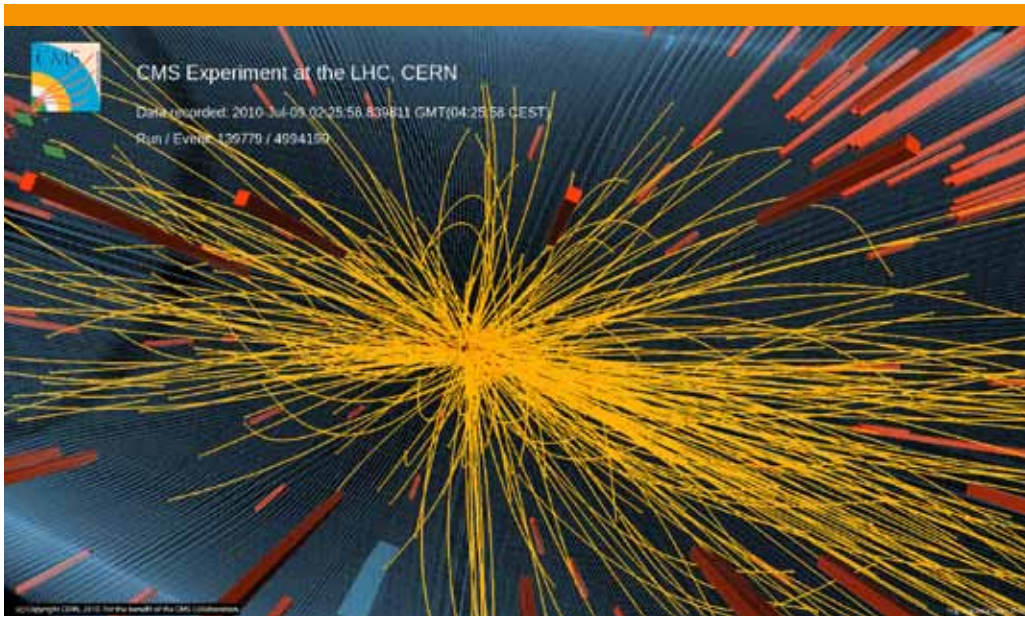
EUDET lives on in AIDA

After five years of running time, a total budget of 21.5 million Euros, participating institutes from Helsinki to Valencia and from Japan to Glasgow and many research infrastructures successfully in place, the EU-funded infrastructure programme for ILC detector R&D EUDET comes to a close at the end of the year. Participants met for the very last EUDET meeting at DESY in September. But instead of final summaries, most of the talks listed future plans and milestones for the EUDET follow-up project AIDA.

EUDET's goal was to create research infrastructures to facilitate detector development, like readout electronics, mechanical structures that enable the testing of different sensor technologies, Grid-ready software and a versatile beam telescope. All tasks have been successfully completed, all activities and tasks achieved their goals and milestones. The infrastructure is in place and is being used by the participating groups as well as by a wider community, including LHC-targeted projects, also in the years to come. "The EUDET community lives on in AIDA and gives it a nice starting point," says former EUDET coordinator Joachim Mnich, now research director at DESY.

Take for example the EUDET telescope: it has served 14 user groups since May 2010 alone, has collected a total of around one billion events and over ten terabytes of data in its 84 weeks of running time. It has also travelled an amazing 8800 kilometres in its life so far — and there are more to come.

Another EUDET success is the calorimeter, for which mechanical structures and new electronics have been built in a worldwide collaboration that, just like software developments, telescope and TPC, will continue to run and improve in the years to come. For AIDA, for example, thousands of new readout chips are available, and important tests lie ahead. *(baw)*



Physicists at CMS hope that events like this one provide clues on the state of matter just after the big bang.

LHC breaks new records

Possible new interpretation of HERA data with CMS observations

The Large Hadron collider LHC – after the successful commissioning and the presentation of the first (known) physics results at summer conferences – now ceased to appear on the front pages. Nonetheless, it breaks new records and makes great progress: the self-imposed goal for luminosity, i.e. the amount of proton collisions per second on a square centimetre, was easily reached by the accelerator experts. With a luminosity of 1.01 x 10^{32} the LHC reached another milestone on 14 October and doubled the intended luminosity before the end of the year. The number of proton bunches broke records too: 320 bunches; and until November, the operators want to increase the number to 400. The LHC will be operated with heavy ions in November before shutting down for a planned winter break.

Meanwhile, the experiments are beginning to see effects that go beyond the rediscovery of the standard model of particle physics. The CMS experiment, for example, observed a correlation in the proton-proton collisions that may point to a state of matter similar to a quark-gluon plasma. "These measurements allow different interpretation possibilities. At these high densities, for example, it is feasible, that more than one gluon of one proton reacts with other gluons of the other proton," explained Hannes Jung, member of the DESY CMS group and physicist at H1. "This may be a signal of saturation effects at a very high gluon density."

The investigation of gluon density in the proton was one of the main topics at HERA. There were indications also at this facility that the density of the "glue" particles in the proton could be very high and there was an intensive search for saturation effects; however, there was no clear evidence possible of this effect. "These correlations shed new light on the investigations that are going on at HERA, too... Is it also possible to find these hints in all the data of HERA experiments?" scientists ask. *(baw)*

New topic area in DESY's school lab: "eLab – experiments around the electron"

On 13 October, Hamburg's State Minister of Science and Research Herlind Gundelach inaugurated the extension of the DESY school lab. With additional room and the new eLab, up to 9000 pupils per year will discover the fascination of natural sciences. State Minister Gundelach also took a chance to do research and got enthusiastic about the new experiments around the electron.

November

2 Public Lecture
Bären, Schneemobile und Polarlichter
Jens Kube, DESY, Hamburg, auditorium, 19 h

10 Science Café DESY (http://sciencecafe.desy.de)
Strom aus der Wüste – Fata Morgana oder nahe Realität?
Frank Lehner, DESY Bistro, 17 h

10-11 **Conference on Cosmic Radiation Fields (CCRF)**
DESY, Hamburg

13-15 **Drawing Exhibition by Ingrid Nikodem**
DESY, Hamburg, foyer auditorium

17 Willibald-Jentschke-Lecture
The Linac Coherent Light Source (LCLS)
Accelerator Physics Challenges of Free-Electron Lasers
Paul Emma, DESY, Hamburg, auditorium, 17 h

17 PhD prize
Presentation of the PhD prize of the Assotiation of friends and supporters of DESY
DESY, Hamburg, auditorium, 17 h

24 Science Café DESY (http://sciencecafe.desy.de)
Normal oder super? – Wozu braucht man Helium bei DESY?
Bernd Petersen, DESY Bistro, 17 h

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

December

1 Science Café DESY (http://sciencecafe.desy.de)
Man or monkey? – The search for our ancestors
Rosemary Wilson, DESY Bistro, 17 h

7 Information lecture Gesund Bleiben
Feldenkraismethode – Schwerkraftforschung am eigenen Körper
Heidje Duhme, DESY, Hamburg, bldg. 1, rm. 4a/b, 16 h

8 Public Lecture
Wenn Licht durch dicke Wände geht – Teilchenphysik bei kleinsten Energien
Axel Lindner, DESY, Zeuthen, SR3, 19 h

15 DESY's Christmas show
Heckers Hexenküche
Joachim Hecker, DESY, Hamburg, auditorium, 19 h

Max Planck back in Zeuthen

Erection of the monument created by Bernhard Heiliger at DESY

by Thomas Naumann

On 21 October, DESY in Zeuthen, the Bernhard Heiliger Foundation and invited guests celebrated the erection of the Max Planck monument.

Bernhard Heiliger, one of the most famous German modern art sculptors, created the Max Planck monument in 1949 on behalf of the German Academy of Sciences in Berlin for the forecourt of the Humboldt University. Because of cultural-political debates, it was banished in 1950 to the guest house garden of the Academy in Zeuthen. In 1973, the former Institute for High Energy Physics – which today is DESY in Zeuthen – transferred the monument to its campus. Since 2006, the monument is standing at its original place, in the forecourt of the university.

In 2010, DESY commissioned a recast of the monument, with the authorisation of the Heiliger Foundation.

„Today, a decades-long Odyssey has come to a happy ending: Heiliger's Max Planck monument returns to its traditional place in Zeuthen," said the chairman of the DESY Board of Directors Helmut Dosch in his inaugural speech.

Helmut Dosch, Thomas Naumann and Sabine Heiliger, after the unveiling of the Max Planck monument at DESY in Zeuthen.

Professor Dieter Hoffmann from the Max Planck Institute for the History of Science illustrated the monument's chequered history and a film informed about the creations of the sculptor's art work.

Subsequently, the monument was unveiled at its new location in Zeuthen. Hopefully, the return of Max Planck to Zeuthen will evoke both the viewer's pleasure and contemplation!

FLASH forward

Positive response to FLASH research workshop

DESY and the Research Priority FLASH organised a workshop on the research programme at FLASH and 130 participants followed the invitation – more people would not have fitted in the seminar room of the FLASH experimental hall. For three days, scientists wanted to make a résumé of the research which has been done so far at DESY's free-electron laser and discuss future experimental possibilities and user requirements. "It has been the best time to do this," said Wilfried Wurth, professor at the University of Hamburg and spokesman of the Research Priority FLASH. "Just then, the scientists had the opportunity to get informed about the new possibilities offered by FLASH after its large upgrade."

Moreover, it was exciting to exchange ideas about future challenges on the basis of past FLASH research. The trend is towards interdisciplinarity. "The FLASH scientists increasingly form larger collaborations," Wurth explains, "and consequently accumulate knowledge and experience from the fields of synchrotrons, lasers and detectors – a very promising model."

Promising is also future planning at FLASH: now that the water window was reached with the production of FEL light of 4.12 nanometres, thus boosting research with biological samples, Edgar Weckert was able to proclaim at the workshop the approval of FLASH II, doubling the number of user stations. Soon, Wilfried Wurth looks forward to special meetings on the design and instrumentation of the FLASH upgrade. The Research Priority FLASH will also be part of it. This programme of the Federal Ministry of Education and Research funds university projects at large scale facilities. At the Research Priority FLASH – incidentally the only project that is not related to an LHC experiment – 14 institutions work at the instrumentation and further development of the FEL. In the three years' funding period starting in 2011, the Federal Ministry of Education and Research will grant 12.5 million Euros. *(tz)*

Let me introduce to you …

New structure of the photon science technical groups

The photon science department (FS) at DESY has undergone significant changes over the past years with the creation of new world-class light sources. At the same time, this also lead to the establishment of new and the restructuration of existing technical groups. Here, we present the group leaders:

From left: H. Graafsma, M. Tischer, W. Drube, S. Bajt, J. Spengler, H. Schulte-Schrepping, J. Feldhaus, H. Franz (not on the photo: T. Kracht)

Saša Bajt worked at NSLS (Brookhaven, USA) and at LLNL (Livermore, US) and developed X-ray optics before she came to DESY in 2008.
Her FS-ML group develops and produces new multi layer X-ray optics for highly brilliant X-ray sources as FLASH and PETRA III.
Wolfgang Drube worked at the IBM Watson Research Center (New York, US); since 1988 he works at DESY and coordinates DORIS user operation. Moreover, he is head of the PETRA III upgrade project.
His FS-DO group is in charge of photon experiments at the DORIS III storage ring.
Josef Feldhaus experimented at the BESSY (Berlin) and NSLS (Brookhaven, US) storage rings before he came to DESY in 1994. He works at the development of beam lines and diagnostics for the free-electron laser FLASH.
His FS-FL group is in charge of the photon experiments at FLASH.

Hermann Franz started to experiment at the PETRA II storage ring in 1998. In the past years, he conducted the build-up of experimental stations at the X-ray source PETRA III.
His FS-PE group is in charge of the photon experiments at the PETRA III storage ring.
Heinz Graafsma worked among others at the ESRF beamlines and detectors in Grenoble (France) before he came to DESY in 2006.
His FS-DS group develops new detectors and detector concepts for photon science and supports work at the measuring stations.
Thorsten Kracht started his research work in high energy physics, he was a member of the TASSO collaboration before he joined HASYLAB.
His FS-EC group supports the experiments with synchrotron radiation in the field of computing.

Horst Schulte-Schrepping experimented in the field of X-ray scattering in Dortmund and, since 1991, develops X-ray optical components at HASYLAB.
His FS-BT group is engaged in the development and construction and of synchrotron beamlines at DESY.
Joachim Spengler came to DESY in 1980 and worked at the ARGUS experiment before he went to HASYLAB and joined the PETRA III project.
His FS-TI group supports the technical infrastructure of the photon experiment departments.
Markus Tischer did research in the field of surface magnetism in Berlin before he became a beamline scientist at HASYLAB.
His FS-US group is engaged in the development and construction of undulators and wigglers for PETRA and FLASH.

Pathfinder

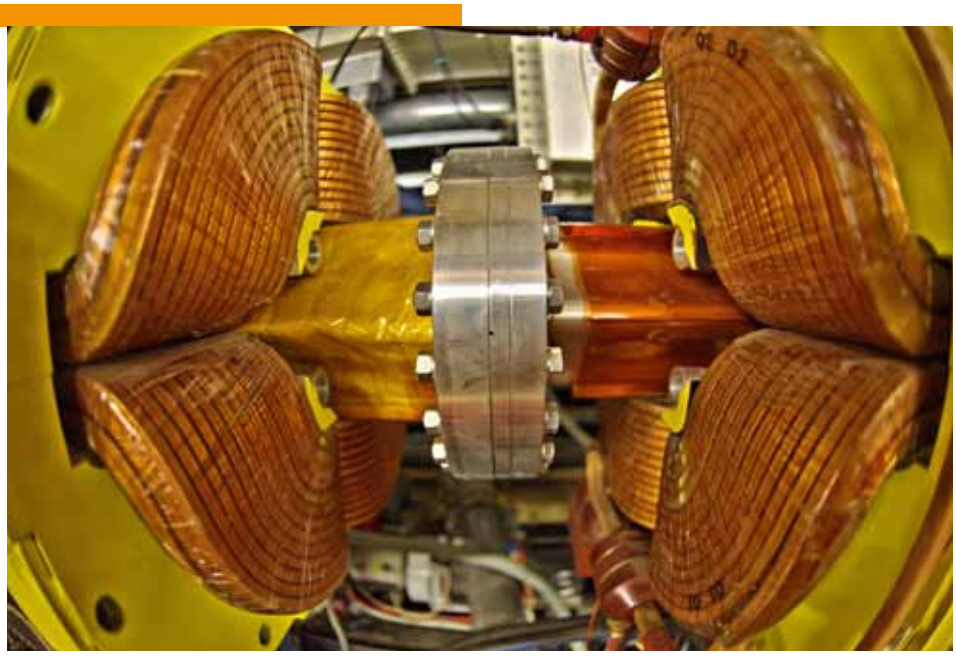
Pupil-based experiments for physics at school

On 7 October, 25 physics teachers participated in a training course at DESY in Zeuthen where they measured cosmic particles with simple pupil-based experiments and evaluated the obtained data.

The experiments that were presented may also be borrowed by schools. This allows offering attractive issues in class. There were questions about which kinds of elementary particles exist, about their physical effects, and which detectors are needed to measure elementary particles. Equally exciting was the measurement of muon rates in relation to the angle, or the measurement of the muon's lifetime as an example for the application of special relativity theory.

After an introductory lecture with a survey of school projects in Zeuthen in the field of cosmic radiation, the teachers had the opportunity to do their own experiments and thus get a feeling on how to integrate this teaching material in their classes, and spot possible problems. Afterwards the teachers got instructions on how to handle – i.e. how to evaluate and discuss – the obtained data.

After the event, some of the participants spontaneously showed their interest to make use of the possibility to borrow cosmic ray experiments from DESY for their school. Not only this response but also the great interest for registration in the run-up shows that this new training concept has successfully been launched and therefore will be repeated next year. *(ub)*



“Kissing lips” - Heiko Römisch‘s photo won third place in the global jury vote.

Four in a row

DESY wins at Particle Physics Photowalk 2010

The first international photowalk - and DESY among the best: photographers won four of the six prizes with pictures taken at DESY. First of all Peter Hildebrandt: with his picture of a H1 wire chamber, the hobby photographer from Pinneberg convinced both, the international jury and the public voters. The winner of the national competition took second place in the global jury and clearly won the first place in the people’s choice. In fact, Hildebrandt specialises in nature photography, but the photowalk at DESY had a great impact on him: “I now really like taking technical pictures,” said the winner.

Pictures taken at DESY also won the third place of the global jury and of the public voters: Heiko Römisch’s photo of two quadrupole magnets convinced the jury who called it the “kissing lips”. Many participants of the public internet vote thought Matthias Teschke’s picture of the HERA tunnel to be excellent. Thus, three of the photographs DESY submitted to the competition won four prizes.

All in all, the photowalk was a great national and international success: more than 200 photographers participated in this global event and many wonderful pictures were taken. The first prize of the jury went to a picture taken at TRIUMF in Canada.

The next voting is just around the corner: by the end of this year, the winners of the internal DESY photowalk will be determined by a DESY choice. *(gh)*

HELMHOLTZ ASSOCIATION

Research for safe waste disposal

Nuclear power plants do not only produce electricity but also radioactive waste that has to be disposed safely for thousands of years. At the Karlsruhe Institute of Technology (KIT), scientists in an international cooperation are trying to transform highly radioactive waste into less hazardous substances. This procedure is called partitioning and transmutation. Through transmutation, the highly radioactive residues will be transformed into other less hazardous isotopes, with a substantially shorter decay rate. Currently, the transformation of radioactive nuclear waste is still dreams of the future; many research questions are still open. However, there are plans as to how and where such a transmutation plant may be built for demonstration purposes. A feasible location would be the nuclear research centre in the Belgian town Mol. The realisation of such a demonstration plant would however take 15 to 20 years.

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Georges Charpak deceased

There is hardly any particle physics detector not being equipped with one of his inventions: the French physicist Georges Charpak, Nobel Prize winner and inventor of the wire chamber died at the age of 86 years. Charpak’s ideas have not only heralded the start of electronic data taking in large scale detectors, thus revolutionising basic research; his inventions are also to be found in many other applications, e.g. in radiology or nuclear medicine.