DESY inFORM.

07&08/2010
Newsletter of the
Research Centre DESY

TULA drills Herlind tunnel

Christening of tunnel and tunnel boring machine for the European XFEL

"I hereby christen this new shield tunnelling machine TULA – Tunnel for Laser. We wish TULA the fewest possible obstacles in its path under the earth, a technology that always functions perfectly, and safe labour for everyone involved!", said the patroness of the machine, Imke Gembalies from the European XFEL GmbH, before taking the scissors on the red cushion and cutting the ribbon. Under the applause of almost 600 spectators, the champagne bottle duly shattered against the hull of the first tunnel boring machine for the European XFEL.

TULA is an impressive sight: 6.17 metres in diameter, 71 metres long and weighing 550 tonnes, the giant drill sat ready for action against the eastern wall of the shaft on the construction site Schenefeld. Before the machine could start its 2.1-kilometer-long journey towards DESY-Bahrenfeld, however, an old custom had to be honoured. Like mining, tunnel construction follows a special tradition that still plays an important role for miners and tunnel builders. Before construction begins, tunnel and boring machine are christened in an oecumenical service by their respective patronesses. In addition, a wooden statue of Saint Barbara is blessed and put up in a shrine on the tunnel wall. As patron saint of the miners and tunnel builders, she is said to protect the workers from the dangers connected with their labour.

Tunnel celebration at the European XFEL: tunnel and tunnel boring machine were christened on 30 June.

Around 560 guests – staff members of European XFEL GmbH and DESY, as well as many guests from politics and science – gathered on the future research campus of the European XFEL in Schenefeld on 30 June for the christening ceremony, which was accompanied in proper style by the miners' choir "Ruhrkohle-Chor" from Herne. Among the guests were Schleswig-Holstein's state secretary for science, Cordelia Andreßen, Karl Eugen Huthmacher from the German research ministry and Hamburg's state minister for science, Herlind Gundelach, who took on the office of patroness of the tunnel sections excavated by TULA. As such, she is regarded by the workers as the earthly representative of Saint Barbara during the construction time, and the tunnel traditionally bears her first name: "Herlind tunnel".

TULA, whose name was determined in a public contest by the Hamburger Abendblatt newspaper and announced today at the christening, is the larger of the two boring machines for the European XFEL. The smaller one, which will excavate the tunnel sections underneath the Schenefeld research campus, will start at the end of this year. *(if)*

The Cup goes to Germany

Kirsten Hacker and Florian Löhl have won the Faraday Cup 2010. Hacker (DESY) and Löhl, formerly DESY, now working at Cornell University, were awarded at the Beam and Instrumentation Workshop BIW10. Both laureates received the Cup for a newly developed diagnostic technology. The technique tested at FLASH uses short light pulses to determine the arrival time of a particle bunch in the accelerator with a precision of six femtoseconds. Simultaneously, the beam position can be set with an accuracy of three micrometres.

DIRECTOR'S CORNER

Dear colleagues,

we had just concluded the 50th anniversary year of DESY with a fabulous event when the next event was just around the corner. On 30 June, there was a christening ceremony for the European XFEL tunnel boring machine. This important milestone for the XFEL project is at the same time the starting shot for the drilling works of the XFEL tunnel. The boring machine will move forward about 10 metres a day and reach the DESY site in about a year.

FLASH is also running perfectly: soon after it had been put together and back into operation, the colleagues already measured the highest photon and pulse energy ever reached at FLASH. The sophisticated upgrade of the FLASH accelerator proved successful and the efforts of the colleagues had paid off. All experimenters are now looking forward to the next user period where they can use the new quality of the FLASH beams in their experiments.

There is also good news from the FLASH II project. So far, the project has managed all obstacles; recently the discussions among the senate of the Helmholtz Association. Only the approval of the funding agencies' committee is pending.

Whereas DORIS had to cope with some difficulties at the beginning of this year, developments at PETRA are very positive. Especially the operating mode called top-up, with a nearly constant beam current, substantially contributes to the stability of the machine and – most of all – to the stability of the X-ray optical components of the photon beamlines. This is another basic prerequisite for highly-sensitive experiments at the nanoscale that will start with the first official user period after the summer break.

Yours,
Edgar Weckert

Perfect restart at FLASH

Upgrade of the free-electron laser successfully concluded

Good planning is the linchpin of an accelerator upgrade: in the shortest possible time, all components of the facility have to be replaced, newly installed or optimised and finally, everything must run smoothly at the restart. Again, the planning of the FLASH team proved to be perfect. "Everything worked well – we stayed on schedule," said Katja Honkavaara, coordinator of the FLASH upgrade.

Best proof for the perfect restart became evident on 6 June, when FLASH produced laser beams with a wavelength of 4.5 nanometres for the first time. FLASH commissioning has not completely finished, but the new accelerator elements – including an additional accelerator module, replaced RF stations, a new electron source – have already demonstrated their potential.

The seventh accelerator module is installed in the FLASH tunnel.

With the new seventh accelerator module, the electrons can now be accelerated to 1.2 Giga-electronvolts instead of 1 Giga-electronvolt.

The 40 metres between the accelerator section and the undulators that produce the light were also submitted to alterations. "sFLASH" has been installed there, an experiment to test seeding, another form of producing laser light in the FEL.

The third user period that is to start soon will run for about a year. Nevertheless, the FLASH team will still do some testing before the first users start taking data. The testing programme includes experiments with different pulse lengths, i.e. electron bunches with varied lengths, and long pulse trains. However, looking back at the course of the upgrade, the FLASH team is confident that the testing will come off as well as the whole upgrade. *(gh)*

Jerzy M. Nogiec (right) from Fermilab and Jan-Hendrik Thie (DESY) check whether everything is going smoothly at the commissioning of the cavity tuning machine.

Fine tuning for professionals

The industrial production of the European XFEL cavities is being prepared

Two European companies will soon receive a special kind of order: the delivery of more than 600 superconducting TESLA cavities for the European XFEL accelerator. As in many other free-electron laser research fields, the collaboration with industry means breaking new ground: “This is the first time ever that firms are assigned the complete production process, including the intermediate RF tests, the final chemical treatment and cleanroom assembly,” explains Wolf-Dietrich Möller, head of the DESY MHF-sl group, responsible for the superconducting RF components of the accelerators.

The production is quite sophisticated. There is only a very narrow tolerance for the designed contour of the cavities’ inner surface, which is to guarantee the required resonant frequency and the effective performance of the accelerator. Although the nine-cell cavities are measured after each production step and shrinkage of the half-cells during welding is previously compensated, it is nearly impossible to keep this tolerance during manufacturing. Instead, a method has proven successful that “tunes” each individual cell of the finished cavities like a musical instrument to reach the correct (accelerating) resonant frequency.

For the exact adjustment of the resonant frequency to 1.3 Gigahertz, each company gets a cavity tuning machine from DESY. The finished cavity will be clamped into the machine and mechanically deformed before being welded into its helium tank. The machines are a further development of a tuning machine that has been used at DESY since the nineties. The total tuning cycle of a TESLA cavity takes about four hours, thanks to the semi automation.

A total of four machines have been built in a collaboration between Fermilab, KEK and DESY. DESY provided mechanics and electrical system, Fermilab provided the control electronics and the software. In June, the electronics racks from Chicago were delivered at DESY; in the meantime the developers from Fermilab and DESY started to commission the facilities. When the machines are running, the industrial cavity producers will be invited to attend training in fine tuning. They will bring a pilot series of their own cavities and get machine operating instructions from the DESY staff. After that, the tuning machines are installed at the production companies and the main series of the European XFEL cavities will go into production – well tuned. *(tz)*

CE seal – a first at DESY

Both the cavity tuning machines and the half-cell measuring machines, also built for the cavity fabrication, are the first ones produced at DESY that bear a CE seal. The CE seal (Conformité Européenne) indicates that the machine has been manufactured and can be safely operated according to EU regulations. When DESY builds machines for in-house use, such labelling is not necessary – this is also true for a complete particle accelerator. If machines – for example cavity tuning machines – are passed on to other users or put into circulation, this seal is mandatory. This certification costs a lot of money but it has advantages, too. “Jens Iversen’s and Jan-Hendrik Thie’s team had thoroughly minimised hazards at machine handling and provided for all contingencies. Now we have every right to claim that the machine can be operated safely by trained persons also outside of DESY,” says Wolf-Dietrich Möller.

Science simply illustrated

Like this wine bottle located between two (nearly) parallel mirrors, an array of atoms was excited by synchrotron radiation to verify the collective Lamb shift. The experiment of Ralf Röhlsberger et al. made it onto the cover of "Science" on 4 June.

WHAT'S ON AT DESY

July

7 Science Café DESY (http://sciencecafe.desy.de)
Zurück in die Zukunft – Ist Vergangenheit veränderbar?
Waldemar Tausendfreund, DESY Bistro, 17 h

20 **CFEL symposium**
DESY, Hamburg, FEL seminar room, 9 h

20 **Topping-out ceremony CFEL building**
CFEL construction site, DESY, Hamburg, 15 h

August

25 Science Café DESY (http://sciencecafe.desy.de)
Lichtsegelschiffe im galaktischen Magnetfeld
Waldemar Tausendfreund, DESY Bistro, 17 h

28 Concert in Tonali10 Grand Prix
Der Dichter spricht
DESY, auditorium, 20 h

September

1 Public Lecture
Die Entdeckung der ersten Elementarteilchen
Jost Lemmerich, DESY, auditorium, 19 h

8 Science Café DESY (http://sciencecafe.desy.de)
Was die Welt im Innersten zusammen hält – Die kleinsten Bausteine der Materie
Burkhard Reisert, DESY Bistro, 17 h

13-17 IWAA (http://iwaa2010.desy.de)
11th International Workshop on Accelerator Alignment
DESY, Zeuthen, seminar room 3

21-24 Theory Workshop
Quantum Field Theory – Development and Perspectives
DESY, Hamburg

22 Science Café DESY (http://sciencecafe.desy.de)
Die größten Rätsel und die kleinsten Teilchen des Universums – Die Weltmaschine LHC
Thomas Schörner-Sadenius, DESY Bistro, 17 h

29 Public Lecture
Gefahr und Nutzen von Vulkanen - Vulkanologie und Geothermie in Island
Sveinbjörn Björnsson, DESY, auditorium, 19 h

Reinforcement

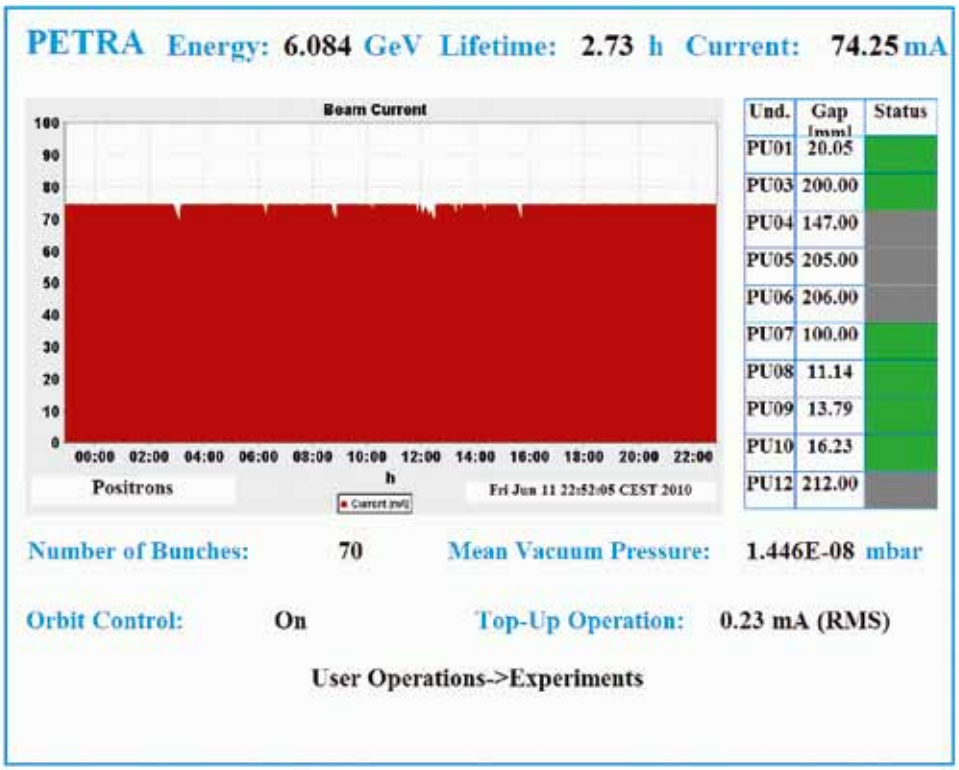
Martin Pohl appointed professor at the University of Potsdam and DESY

"Parallel worlds: the non-thermal universe" – this was the topic of the inaugural lecture and official introduction of Martin Pohl to his colleagues and numerous students as a newly appointed professor for theoretical astroparticle physics at the University of Potsdam. Last year, Pohl accepted a chair at both the University of Potsdam and DESY in Zeuthen. He works on a wide area of subjects ranging from the acceleration of high-energy particles in the universe to the exploration of dark matter. He is interested in the unsolved questions of modern astroparticle physics – the origin of cosmic radiation and the emergence of extra-terrestrial magnetic fields are two of the exciting topics to be intensively examined by Pohl's workgroup.

Martin Pohl

Pohl believes that the dialogue between teachers and students is an essential feature of qualified academic education. "In the course of their academic career, students should come in contact with current research as early as possible" – with this approach, the young scientists will expect a top-class qualification in modern astroparticle physics.

Prior to his appointment, Pohl had been faculty member at Iowa State University for six years, working among other things as a NASA Interdisciplinary Scientist for the gamma ray observatory GLAST. Martin Pohl was born in Kempen in 1965 and obtained his doctorate at Bonn University in 1991. After several research activities, he habilitated at Ruhr University in 2002. *(ub)*



PETRA III in top-up mode. The beam current remains constant four hours, only few small dips show small remaining problems.

PETRA tops up

The X-ray source is running in top-up mode

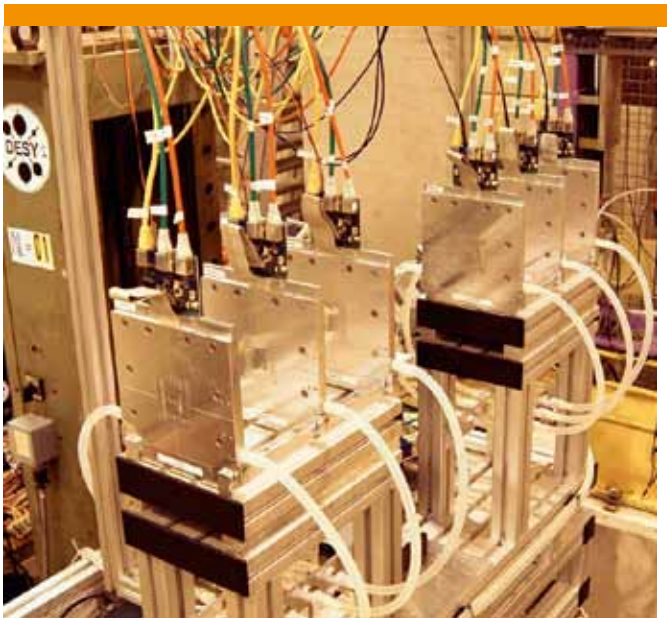
The world's best X-ray source has one more new feature: PETRA is running in top-up mode. Every few minutes, the circling particle bunches are topped up to keep the intensity of the beam current and the brightness of the X-ray flashes on a constant level. This operation mode has advantages for both the machine and the experimenters: at a constant beam current, the accelerator is subject to a stable thermal load with nearly no thermal expansion, and the users in the experimental hall can do their experiments with a consistently high light intensity.

The brightness will have a tolerance of not more than one percent. To achieve this, the number of particles in the circling positron bunches are measured every two minutes and – dependent on the intensities in the DESY II pre-accelerator - each of up to 100 bunches are injected with a small amount of positrons, the bunches with the fewest amount of positrons first. "The injection disturbs the stored beam for a short time, but after circling a few thousand times, everything is just as it was before," explains Klaus Balewski, responsible for the PETRA III accelerator. Some thousand orbits take only a few milliseconds. The users will hardly notice the topping up of the bunches.

In March, the top-up mode was tried out at PETRA III for the first time – manually at that time. Now, the topping up of bunches runs automatically. Small problems occur now and then, for example, when DORIS has to be injected simultaneously. However, the objective is clear: "In the long run, we will be able to operate the accelerator in a quasi fully automated mode for hours and hours," says Balewski. *(tz)*

A telescope roadmovie

A story about how everybody can bring science forward



The EUDET telescope installed at the CERN test beam.

from ILC Newsline

I don't usually start stories for ILC NewsLine with the word 'I'. This time I have to make an exception, because for a change I was not merely a spectator and communicator of science, but a facilitator (of sorts). One of the actors in something both very mundane and very exciting: transporting scientific equipment from one lab to another. On Sunday 30 May, the EUDET beam telescope was brought from DESY to CERN, and I was one of its (three) drivers.

The telescope goes to CERN for a round of shifts with upgrades for the ATLAS detector at the Large Hadron Collider (LHC) and a few other R&D projects. It thus has an extremely full agenda at CERN until the end of November (the time when telescope manager and part-time science delivery woman Ingrid Gregor gets back into the telescope van and hauls it all back to DESY, hopefully seeking driver company).

The telescope van is waiting for the start in the DESY hall.

The beam telescope is about as versatile as the people who use it. You need it to check whether what you think you see with your detector really is there, a sort of cross-check mechanism, only with lots of added value. In labs around the world, scores of physicists are already working on new generations of particle detectors – like the ones busy taking data at the LHC at CERN right now, but even faster and ready for the next generation of accelerators. These new devices need to be tested. There are test beams at all the major labs around the world, including DESY and CERN, and depending on the particles and beam times available you choose where you test your detector. So that's why sometimes the telescope has to move from one place to the other.

So on Sunday morning, (almost) at 8:30 sharp, the three drivers were there to load the remaining transportable goods into the van. The telescope, safely packed into two crates, and its support structure, were loaded on Friday; what remained was a collection of items that somehow all had to get from DESY to CERN – three removal boxes whose owner now needed them in his office at CERN, the bicycle of driver number three, Volker Prahl, for mobility between the two CERN sites, two crates of beer for Germans living in France missing a good brew, Volker's wife's legendary salad, my less legendary meatballs, Ingrid's eclectic CDs and all the necessary paperwork. A box of electronics also needed to go back to Göttingen university, which lies at about one quarter of the way.

We had agreed to rotate driving duty and I got to go first. And then, well – it all went well. We made it to the Göttingen appointment albeit it with a two-hour delay, narrowly missed an empty-tank moment just outside Heidelberg, drove past a clouded Blackforest panorama, watched strawberry pickers from our elevated van seats, used the magic word "CERN" to get passage stamps from German and Swiss customs, and only in France a few metres from our final destination did we overlook a speed bump, giving the telescope a good rattle. But it survived, was put up the next week, and is now serving the first user group, the ATLAS pixel developers and the British Fortis team.

Science is about big questions and incredible quests. It inspires and awes and makes you wonder about the wondrous things the human brain is capable of. In order to get to the quests and questions though, you need a lot of nuts and bolts and muscle. A twelve-hour trip in the car, a couple of weeks in the test beam with the telescope can mean an important, maybe decisive step towards a new technology and a new era in science... I am happy to report that I have now done my little bit to help future discoveries onto their feet, along with a bowl of salad and some Queen classics. *(baw)*

Herb spiral and raised bed in the Kinderwelt@DESY kindergarten.

What do we eat today?

Award for the “food chain” project of DESY’s kindergarten

When you enter the DESY campus at the main gate, you have surely seen it: the DESY kindergarten Kinderwelt@DESY has a raised bed, an herb spiral and also a compost heap. These are a visible sign for a very extensive project of the day-care centre in which many questions of nature are scientifically solved. For the project “What do we eat today?” the kindergarten was recently awarded at the Altona town hall with the “Kita 21” prize. The project includes not only planting and cultivation of the beds but also cooking, visits to the weekly market and to a farm, and much more.

„We associate all our topics with sciences, and also here the kids have the opportunity to become little scientists,” said Nicole Meyer, advisor for ecology and natural sciences at the kindergarten. She considers it particularly important that the kids know where the food comes from and that they appreciate it. “I am always alarmed when I see how carelessly some people handle food in the supermarket.” However, the award does not end the project – it is to continue next year because of its great success. New projects are also planned – the kindergarten will concentrate on energy in the coming year. *(gh)*

INFO

More information on Kita 21:
www.kita21.de

HELMHOLTZ ASSOCIATION

Sequencing of submarine forests

The biologists Klaus Valentin and Bank Beszteri from the Alfred Wegener Institute contributed to decode the genome of the brown algae which is completely sequenced now. The sequencing of the brown algal genome is important to trace back the evolution of photosynthesis. “We now know that oxygen-producing photosynthesis was “invented” about 3.8 billion years ago, by cyanobacteria, sometimes erroneously called ‘blue-green algae’”, says Valentin. “Green and red algae have developed this ability after their ancestors scavenged living cyanobacteria, and thus more or less captured photosynthesis.” Brown algae were assumed to have arisen from the fusion of photosynthetically inactive colourless cells with a unicellular red alga. The role of brown algae in the ecosystem is similar to that of trees on the mainland. As “submarine forests” they are an important habitat for marine animals.

www.helmholtz.de/hermann

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Counting chicks after they are hatched

Six kestrels hatched in the nesting box at building 2a this year. Now, the chicks are already eight weeks old and fully fledged. Last opportunity to watch the kestrels’ offspring live via the kestrel cam at:
www.desy.de→News →DESY News→kestrels

Brochures for everybody

Get your copy of the “SPEED MACHINE”! The new brochure covering the accelerator sector completes the series of research brochures at DESY. This 56-page issue that can be picked up at PR in building 1 gives an overview on development and operation of high technology for particle accelerators at DESY.