

Light at the end of the magnet?

ALPS searching for very light particles

Admittedly, this sounds quite absurd at first sight – absurd, but also quite fascinating. Imagine a world existing parallel to our world that we practically do not perceive at all. Some scientific theories suggest that such a world exists, but nobody has ever seen it. With unprecedented accuracy, the ALPS (Any Light Particle Search) experiment is now searching for particles from such a world. In case it does exist, this would immediately support new theory models like string theory and also explain unresolved phenomena like dark matter and dark energy. The problem is that the suspected particles of this hidden world are much lighter than everything we know and they hardly interact with our matter. They are called WISPs (weakly interacting sub-eV particles).

In search of the hidden particles, ALPS sends a laser beam through a superconducting HERA dipole magnet with a built-in optically opaque wall in its centre. In case WISPs do exist, single photons from the laser beam could transform in the strong magnetic field of the HERA magnet to these particles and traverse the wall. On the other side of the wall they could be revealed because some of them transform again into photons. These can be detected at the end of the magnet with a camera.

Initially, ALPS had been installed in the former HERA magnet test hall to check measurements of the Italian



Inside this magnet the light may shine through the wall: the ALPS setup in the HERA magnet test hall.

PVLAS experiment. In 2006, this experiment caused a sensation when it announced to have seen signs of an axion-like particle, a representative of the WISP group. However, the worldwide search for this particle has so far been without results. This is why the ALPS collaboration carried out an upgrade by extending the previous search for axion-like particles to all ultralight particles which might be flying around in this parallel world – called “hidden sector” by physicists. The structure of ALPS was modified to become the most sensitive instrument for light particles. The scientists paid special attention

to the injected laser light. The more of it is injected, the more likely it is that a hidden particle is revealed.

The ALPS scientists are storing the light of the injector laser with a so-called optical cavity, a mirror system within the HERA magnet which reflects the laser light back and forth practically without loss in a vacuum system. This way the photons of the laser beam have multiple chances to produce WISPs. “So far we have had two windows closing the vacuum in the beam path. In spite of

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Summer break

With this July/August issue, DESY inForm will have a one-month summer break. The editorial team would like to wish all of our readers fun holidays and lots of sunshine to go with them. The next DESY inForm will be issued on 3 September. We're also publishing this issue a week later than usual so that you don't have to wait so long for the next one.

International Conference in Hamburg

From 17 – 22 August, the Lepton Photon Conference will take place at the Congress Centre in Hamburg, with talks covering current particle physics research. Students and postgraduate students will present their work in a poster session. The international symposium is organised by DESY and the University of Hamburg. More: <http://lp09.desy.de/>

DIRECTOR'S CORNER



Dear colleagues,

at the European XFEL project we are looking forward to an event which marks an important milestone towards the realisation of our superconducting linear accelerator: on 21 July, the treaty between the state and the Länder Hamburg and Schleswig-Holstein on the financial contribution of the Länder to the project will be signed at DESY. Furthermore we celebrate on the same day the laying of the foundation stone for the more than 4000-square

metre large hall, in which later the test of the niobium cavities, the complete accelerator modules and the waveguide systems for the high-level radiofrequency distribution will take place. From spring 2010 onwards the technical infrastructure and the test stands will be installed so that commissioning of the AMTF (accelerator module test facility) can take place from mid-2011.

The tender procedures for the serial components of the XFEL accelerator are being

prepared with high urgency. The specifications for the industrial production of 800 niobium cavities are already completed. The placement of orders, foreseen for autumn 2009, will be the largest single purchase of technical components in the entire project. The prototypes for the XFEL cryomodels have been or are being equipped with cavities and test results from CMTB (cryo module test bench) will be available soon. In addition to the prototypes, the new modules to be installed at FLASH in autumn

have to be assembled and tested, so that the workload for the infrastructure in hall 3 and at the CMTB and for all the groups involved will remain very high. Installing one of the XFEL prototype modules as the seventh module in FLASH uses synergies between the projects and helps us to keep the very tight schedule.

Sincerely,
Reinhard Brinkmann

the best anti reflective coating, with 0.3 per cent they still reflected too much light," explains collaboration spokesman Axel Lindner. Hence the whole mirror system of the resonator is completely inserted in the vacuum. Now the group is confronted with a basic problem because the rear one of two mirrors – shifted six metres into the magnet – must be actuated by remote control. However, actuators that fit into a vacuum pipe with less than 3.5 centimetres diameter and which are suitable for vacuums and magnets at the same time are not available. ALPS group member Ernst-Axel Knabbe has conditioned the magnetic-field-proof version for vacuum use and designed a mirror control. "Some people said that this will never work. The first tests, however, showed that it is functioning properly," Knabbe beams. After the tests, the laser intensity will be increased. Moreover, the detection limit was adjusted downwards: the CCD camera which will measure the light emitted by the WISPs at the end of the magnet is ten times more sensitive than the previous one. "With the new cavity

without windows and with a better light sensor at its end, we hope to improve the sensitivity of the experiment by a factor of 1000," says Lindner. This would make ALPS the world's best headlight to bring light into the hidden sectors of the universe. The measurements begin this summer.



Ernst-Axel Knabbe in the laser hut of ALPS.

The measurements at ALPS will be finished in autumn 2009, just before the shutdown of the cryogenic facility that now supplies the ALPS magnet with liquid helium. It will be upgraded for future European XFEL operation.

However, the ALPS scientists have further plans: the next stage of extension of a light-through-the-wall experiment is to use the HERA tunnel. In a straight sector, the group wants to shoot a laser beam into a 50-metre vacuum pipe, this time without magnetic field – searching for hidden photons from our parallel world. (tz)

INFO

<http://alps.desy.de>

Unlike the CMTB on the photo the accelerator modules will be shifted horizontally into the test benches in the planned AMTF.



Proper tests are half the acceleration

Construction starts for accelerator module test facility

Large projects announce themselves with halls. Deep holes for the European XFEL project appear at three future facility sites, and starting in July there is another construction site on the north side of the DESY campus. The AMTF (Accelerator Module Test Facility) hall will be built as part of the DESY contribution to the X-ray free-electron laser, to be used from 2011 to test all industrially fabricated cavities and fully equipped accelerator modules for the European XFEL before they are installed in the tunnel.

The size of the hall is about 4000 square metres and it will be built on the former DESY sports ground. "The location must

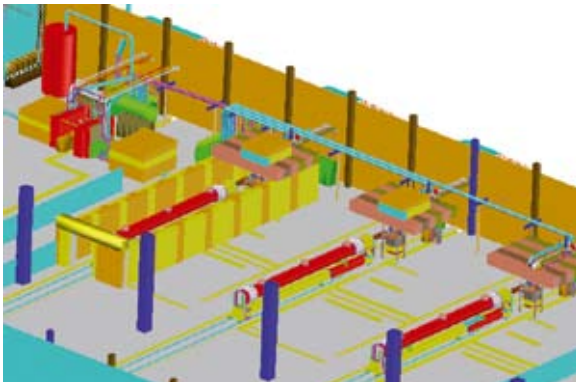
be very close to the cryogenic hall to make supply with liquid helium easy," explains Bernd Petersen. He and his MKS group have planned most of the hall's interior. The hall will be equipped with three test benches for full superconducting accelerator modules, two vertical helium baths for the cavity tests and an area for testing and mounting the waveguides for the RF system.

The quality tests of the cavities prior to assembly of the modules are of great importance to Petersen: "In case something is wrong, we can immediately intervene in the production process before the cavities are built into the modules." For this purpose the cavities, which are already welded into their helium tanks, are dipped in liquid helium in bundles of four and their accelerator field strength and quality are measured. Afterwards the final assembly of the around 100 European XFEL modules takes place in Saclay, France.

After the return transport to DESY, the accelerator modules go through a complete system check in the AMTF

and – except for the lacking particle beam – they are put to the test under operating conditions. Every week, a module is due to return from Saclay and go through a ten to fourteen-day test run. Vacuum and helium leaks, accelerator field strength and thermal insulation – all this is put to the test. After passing this examination, in the back area of the hall the MHFP group will equip the modules with waveguides, and after complete mounting they are transferred to the XFEL accelerator tunnel.

The laying of the foundation stone ceremony will take place on 21 July, with Federal Research Minister Annette Schavan and her colleagues from Hamburg and Schleswig-Holstein, Herlind Gundelach and Jörn Biel. Afterwards, there will be a barbecue party for all DESY staff. The hall is supposed to be ready for technical installation at the beginning of 2010. The first cavities will be tested in spring 2011 and Petersen expects the first modules to arrive half a year later. (tz)



Three test benches for European XFEL accelerator modules are located in the centre of the AMTF hall.



The "DESY - Insight starts here" team during the HSH Nordbank Run 2009 in Hamburg. Their insight: four kilometres can be longer than you think ...

WHAT'S ON AT DESY

July

- 1** Public Lecture
Von FLASH zum XFEL
Elke Plönjes, 19 h, DESY, auditorium
- 2** Science Café DESY (<http://sciencecafe.desy.de>)
Ist 15 nur wahrscheinlich 3 mal 5? – Die Stärken und Schwächen von Quantencomputern
Leonhard Horstmeyer, 17 h, DESY Bistro
- 5** www-zeuthen.desy.de/TdoT
Einblick – Open Day at DESY in Zeuthen
10-17 h, DESY, Zeuthen
- 6-10** PASCOS 2009 (<http://pascos2009.desy.de>)
15th International Symposium on Particles, Strings and Cosmology
DESY, Hamburg
- 7** HertzLecture 2009
Dark Matter in the Universe
Prof. Joseph Silk, University of Oxford
17:30 h, DESY, Hamburg, auditorium
- 8** Public Lecture
Illuminati – Die wahre Geschichte der Antimaterie
Philip Bechtle, 19 h, Zeuthen, seminar room
- 9** Science Café DESY (<http://sciencecafe.desy.de>)
Magnetische Dipole – QUANTENSpeicher in QUANTENcomputern
Waldemar Tausendfreund, 17 h, DESY Bistro
- 21** Foundation stone ceremony
Laying of the foundation stone for the AMTF hall
15 h, construction site AMTF hall, DESY, Hamburg

August

- 17-22** Lepton-Photon 09 (<http://lp09.desy.de/>)
XXIV INTERNATIONAL SYMPOSIUM ON LEPTON PHOTON INTERACTIONS AT HIGH ENERGIES
Congress Centrum Hamburg (CCH)
- 27** Science Café DESY (<http://sciencecafe.desy.de>)
Naturgewalt Tsunami – Was steckt dahinter?
Waldemar Tausendfreund, 17 h, DESY Bistro

September

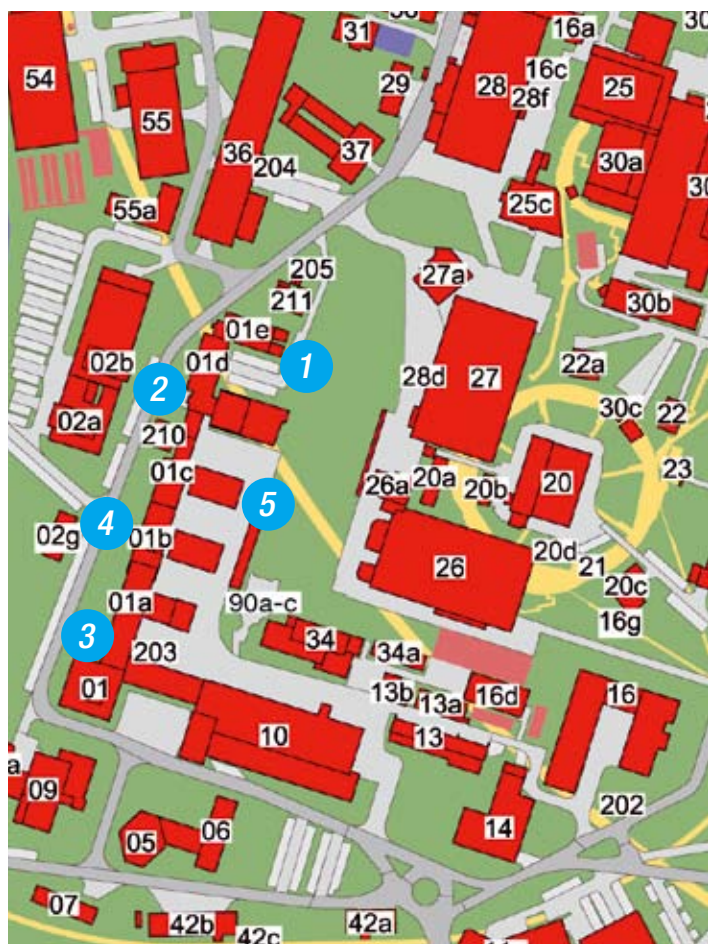
- 10** Science Café DESY (<http://sciencecafe.desy.de>)
Zahlenmystik
Waldemar Tausendfreund, 17 h, DESY Bistro
- 16** Public Lecture
Die Teilchenphysikshow
19 h, DESY, auditorium
- 20-23** GISAS 2009 (<http://gisas2009.desy.de>)
Satellite Conference of SAS2009
DESY, Hamburg
- 24** Science Café DESY (<http://sciencecafe.desy.de>)
Was es nicht gab, wurde eben konstruiert – 50 Jahre Konstruktion bei DESY
Rolf Pamperin, 17 h, DESY Bistro

Birthday celebration of physik.begreifen school lab

Physics can explain why things suck.



Zeuthen vacuum lab since its foundation. „Also in the future our main target is to fascinate and interest pupils in physics,” says Adelheid Sommer from physik.begreifen. “We believe that this way of promoting general education and excellence is a good complement to school education.” (ub)



There's been a mix-up of the 1a and 1b corridors and wings in the last issue of DESY inForm. We apologise for any confusion caused. Here is the schedule of construction phases and with the correct descriptions.

Phase 2: 1d (wing) and 1c (corridor). This will be the new location for the library, which requires a complete remodelling of the basement. This construction phase also concerns the FLA, H1, ZEUS, CMS groups and the directorate.

Phase 3: Foyer building 1 and the first sector of the hallway including 1a (wing). The refurbishment of the foyer building will create new offices for the directorate. The PR department will return to the same offices. The exhibition area will also remain at the same place but the foyer building will get a completely new look.

Phase 4: 1a (corridor) und 1b (wing). This sector will be submitted to “normal” remodelling and restoration; moreover, laboratory rooms will be installed in the basement.

Phase 5: 1b (corridor) and 1c (wing). Like phase 4.

PXFEL1 on its way to
the CMTB test facility.



Preparing for serial production

European-XFEL cryomodule prototypes tested at DESY

In large scientific projects with the collaboration of many countries and institutes you often need creative accounting. For example, if a country declares that it wants to take part in the European XFEL, it also automatically agrees to a financial participation, which must not necessarily be an amount of money to be transferred from one account to another. The so-called payment in kind is made in the form of manpower, assembly parts or sub-contracts. Sometimes, it can also be large yellow cryostats that are delivered as a contribution in kind: the prototype cryostat „PXFEL1“ for the XFEL cryomodule coming from China, which is currently being tested rigorously in the CMTB test facility. China plans to deliver 25 of the 101 cryostats needed for the accelerator and this prototype is to prove that both the production and the module condition after a long transport will meet the high requirements for the European XFEL. The module will be built into FLASH during the coming shutdown.

In order to qualify other manufacturers, two additional cryostat prototypes, PXFEL2 and 3, were ordered from

Spanish and French companies. Both consist of the yellow tank and the “cold mass”, i.e. all helium pipes, insulation layers and suspensions for the resonators. Prototype 2 was delivered from Spain in mid June; the cavity string manufactured at DESY was installed end of June, so that later on the module can in fact be used to accelerate particles. Next spring, when the infrastructure will be finished in Saclay, France, the PXFEL2



Three prototypes will help streamlining cryomodule production for the European XFEL.

will go there because in the future the XFEL cryostats will be assembled in series at that place. In Saclay, scientists, engineers and technicians will disassemble the prototype, test it and assemble it again, thus checking whether the existing infrastructure also works for serial production. Then it returns to the test hall for a 30-day test. The assembly of the third prototype from the French company is scheduled for autumn this year and will afterwards go through the same procedure.

Currently, the production - including all test series, test transports and technical solutions - still takes one year. In the future, one module per week is supposed to be assembled in Saclay before going to the then-completed AMTF test hall. From the hall, the modules are immediately transferred to the tunnel because neither DESY nor Saclay have enough storage space. “When all test series are evaluated to our satisfaction, the awarding of contracts can begin,” says Kay Jensch who is in charge of the prototypes study at DESY. (baw)

FZD joins Helmholtz

On 22 June, the ceremonial signing of the consortium agreement between the Federal Republic of Germany and the Free State of Saxony took place at Forschungszentrum Dresden-Rossendorf (FZD). This agreement provides the basis for supporting the FZD research centre as a future member of the Helmholtz Association with funds of the Federal Government and the State of Saxony. The agreement rules the transition of the FZD from the Leibnitz Society to the Helmholtz Association on 1 January 2011. Federal Research Minister Professor Annette Schavan signed for the Federal Government and Minister President Stanislaw Tillich for Saxony.

The aim of the FZD is to carry out strategic and long-ranging top level research in politically and sociologically relevant research fields like key technologies, health and energy. For the first time in Germany, a complete research centre of the Leibnitz Society becomes a new and independent member of the Helmholtz Association, Germany's largest scientific organisation, with 28 000 employees in 16 research centres and an annual budget of approximately 2.8 billion Euros.



Hands-on physics: visitors in action at the night of science.

The brightest night of the year

Long Night of the Sciences in Berlin and Potsdam

DESY in Zeuthen and the Physics Institute of the Humboldt University Berlin participated once more in the night event in Berlin "From Quarks to the Universe – current research projects of Humboldt University Berlin and DESY in the field of particle and astroparticle physics."

On 13 June, more than 2300 curious and interested Long Night of the Sciences visitors came to the Lise Meitner House foyer in Berlin Adlershof.

"Science is not only important raw material for the economic and social development of our society but always an exciting adventure, too," said the chairman of the Long Night of Sciences

board Professor Reinhard Thümer, and the high number of adventure travellers to the world of elementary particles of the universe confirmed this statement.

During the whole night, topics like particle collisions at highest energies at CERN in Geneva, ghost particles at the South Pole or exploding stars were discussed with scientists on site. Apart from lectures, films, posters and exhibits, also the younger public was entertained with exciting experiments at the physik.begreifen stand. (ub)

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Brilliant ideas

The German research ministry BMBF has redesigned the internet presence of the German Government's high tech strategy. On the web sites www.ideen-zuenden.de or www.hightech-strategie.de you can find new attractive modules like "Ideen-zünden-TV" (brilliant ideas TV) presenting the newest developments of advanced technol-

ogy or "TOP 100 inventions" evaluating pioneering inventions regarding their scientific relevance. Moreover, a newsletter (in German) is released every two weeks which you can subscribe to at www.bmbf.de -> Service -> Newsletter "Hightech-Strategie für Deutschland".