CERN Bulletin

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An interview with the Director-General

At its March meeting, the Council took the step of extending Rolf Heuer's mandate until the end of 2015. What can we expect from the extra two years?

Extensions to Director-General's mandates are few and far between, with the last being for Herwig Schopper, who served an eight-year term in the 1980s. For Rolf Heuer, the proposal was raised by the Belgian delegation, so we asked delegate Walter Van Doninck why the Council felt that circumstances warranted an extension now. "We felt that the LHC's first long shutdown needed management continuity, given the important nature of the work to be carried out," he explained. "That's why we proposed extending the mandate of the current Director-General." James Gillies spoke to Professor Heuer to find out what he plans to achieve with the extra time.

James Gillies: First of all, how do you feel about your time in office so far?

Rolf Heuer: I feel I'm about midway! Seriously, I think this organisation has achieved a lot in the last three years, and I'm reasonably happy with the initiatives we've launched, but there's still work to be done in areas as diverse as the research programme, which is always top of my mind, opening to new members, and capitalising on the LHC's public and media visibility for the benefit of science as a whole.

JG: Where would you like CERN to be at the end of your mandate?

RH: I'd like to leave a well functioning accelerator complex with a broad spectrum of research and a 15-year LHC programme getting underway. To make sure this happens, we need to ensure that our infrastructure is up to the task, so I'd like to see the consolidation process reach maturity. I'd like

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An annual performance appraisal for CERN

The March Council session is the occasion for CERN's annual performance appraisal, but instead of the MARS form familiar to CERN staff, the lab's working document is an Annual Progress Report, linked to the Medium-Term Plan, matching achievements to objectives. This year, I think it's fair to say, we were firmly able to tick the 'achieved' box.

Top of the list of objectives was the LHC, which exceeded expectations in 2011 by delivering over five times the anticipated luminosity for

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An interview with the Director-General

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to see a clear vision emerging for the next global project in particle physics, with the European Strategy update making a contribution to this. I also hope that CERN will have made a big step forward concerning Membership and Associate Membership.

JG: How much of your time do you expect to spend visiting prospective new members?

RH: I'm anticipating a considerable amount of travel over the next one or two years to pave the way. After that, I hope the process will be well in hand.

JG: How do you see CERN's relationship with other major particle physics labs developing?

RH: We have a very good relationship with the other major players, and I see that relationship getting closer over the coming years. If a country chooses to become a Member or an Associate Member of CERN, that doesn't prevent it from participating in programmes at other labs. Nor does it prevent CERN playing a major role in global projects elsewhere if that's the way things develop. As Director-General of CERN, however, I would not be doing my job if I didn't make the case for CERN to host a post-LHC facility.

JG: What are your expectations for the long shutdown?

RH: The first priority, of course, is to get the LHC ready for higher energy running, and this is a huge task. In 2013, we will not be running our accelerator chain, since all manpower is needed for the LHC. That said, I want to ensure that we make the best of the long shutdown to ensure sustained interest in CERN, and to set the scene for the lab's 60th anniversary in 2014, which I hope will be celebrated in all our Member States. I also hope that people will use the shutdown to think of how we can do more with the non-LHC programme.

JG: Is the world's financial situation a worry for you?

RH: Each time I give an interview or a talk, I'm asked about the economic crisis and its impact on CERN. That's why we need to work extra hard to make the benefits of our research known, and to ensure that the load is more evenly spread through the process of opening to new members.

JG: You've put a lot of emphasis on public engagement. Is there still work to be done on this front?

RH: Apart from the purely altruistic reasons for engaging with the public, this question is intricately linked to the last one. People's lives increasingly depend on science, and the resolution of many of society's problems rests on complex political and scientific issues. If we're to succeed, we have to make science an integral part of society.

JG: Will there be any changes to your management structure?

RH: We have a good team in place with a mandate to the end of 2013. The current structure works well, so I don't foresee any immediate changes. And as the Council said, we need continuity, so any changes will be evolutionary not revolutionary. Management stability is needed at this important moment in CERN's history.

JG: Is there anything else you'd like to add?

RH: I'd like to thank the CERN community for its continuing dedication to the task. I'm often asked how we manage such large communities with such flat management structures, and the answer is simple: when you've got a group of highly motivated people all going the same way, it makes the job easy. I'd also like to say that I hope my mandate will be marked by openness in communication, and in that spirit, I'd like to renew my invitation to CERN people to let me know, via the Bulletin, what subjects they'd like me to cover in my regular messages from the DG. I can't guarantee to cover everything, but I will do my best.

James Gillies

LHC Report: First collisions soon

On the evening of Friday 16 March beams were accelerated in the LHC at 4 TeV for the first time: a new world record! According to the schedule for the machine restart it will take another three weeks before the stable beams mode – the requirement for the detectors to start taking data – is achieved.

During the beam commissioning period the equipment teams make sure that their systems – beam instrumentation, radio frequency, beam interlock, feedback on orbit and tune, etc. – are working flawlessly with beam. Confidence in the correct functioning of all the magnets, their settings and their alignment is obtained by detailed measurements of the optics and the physical aperture. The optics measurements include the beta* of the squeezed beam at the centre of the experiments where the collisions will soon take place. This year the aim is to have a smaller beta* of 60 cm for the ATLAS and CMS experiments. As a reminder, smaller values of beta* mean thinner and more squeezed beams at the collision points.

A lot of time is devoted to guaranteeing the safety of the machine. The small beta* requires that, at full energy, the collimators be positioned very close to the beam. The collimation system is carefully set up in different machine modes (injection energy, full energy, full energy with squeezed bunches and with collisions). By provoking beam losses and making "loss maps", operators verify that the beam is actually lost in the collimation region and not on any other machine elements where it can cause damage.

All these tests and measurements are being performed with one or very few, often low-intensity bunches. Initially, even with the stable beam mode officially achieved, only three bunches in each direction will circulate in the machine. At this point, the experiments will be switched on to check the correct functioning of their detectors with beam. With a bit of luck, good availability of the machines and a lot of hard work by all the teams involved, the first stable beams will be achieved next week.

Jan Uythoven for the LHC team

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An annual performance appraisal for CERN

protons while improving the lead-ion integrated luminosity by an order of magnitude compared to 2010. As a result, the experiments published over 190 papers and made a staggering 1900 conference presentations. Underpinning this was the Worldwide LHC Computing Grid, which routinely performs so well that we hardly notice it's there.

Non-LHC physics also had its day in the sun in 2011, with experiments at the PS, SPS, AD, n_TOF and ISOLDE, as well as the non-accelerator searches for the dark matter candidate Axion particles, all making solid progress. Looking further ahead, the High-Luminosity LHC project formally got under way, and the CLIC test facility successfully demonstrated the feasibility of key issues for this novel accelerator technique. With all this activity to work with, the Theory group had a busy year, producing some 324 preprints.

2011 saw the first tangible results of CERN's policy of opening up to the world, with Israel becoming an Associate Member in the pre-stage to Membership. Serbia has since joined Israel, and negotiations with Cyprus, Slovenia and Turkey all got underway.

In training and outreach, 2011 also saw new highs, with close to 450 FTE CERN Fellows, 1,100 high school teachers, a record 77,000 public visitors, 195 VIP visits and 394 media visits. Interest in our science has never been higher, and at the risk of sounding like a stuck record, I never miss the opportunity to remind the Council that this is good for science as a whole.

Our general infrastructure and support for staff and users improved considerably in 2011, with better shuttle services, car and bicycle sharing services and a single point of entry for the help desk. We also made advances in HSE issues, notably with a tri-partite agreement with our host states that streamlines the way we deal with radioactive waste.

As Annual performance appraisals go, it was a long one, but largely positive. And as part of CERN's medium term planning process, the Annual Performance Appraisal is embedded in a formal planning process that currently takes us to 2017. Much can happen in that time: planning requires an open mind and long-term strategic vision. Fortunately for CERN, these are factors that have always characterised our governing body.

Rolf Heuer

The fundamental mass (this is not about the Higgs)

At a time when we are about to shed light on the fundamental question of the creation of mass after the Big Bang, we are also close to solving another basic mass-related problem. The kilogram is the only base unit of the International System of Units (SI) whose official definition is still based on a material artefact rather than on invariant quantities. If you are now thinking that this concerns you less than the glamorous Higgs boson, think again: your scales could give you a different value when you use them tomorrow.

The international prototype of the kilogram is a cylinder of platinum-iridium alloy whose height (39 mm) is equal to its diameter. It was machined in 1878 and is kept at the Bureau International des Poids et Mesures (BIPM) in Sèvres, near Paris. To date, while all the other units in the SI system have been redefined to be based on fundamental constants or atomic properties, the kilogram continues to be defined according to this piece of matter.

A piece of matter that people, or at least one person, must clean, and there is a risk that atoms – that is, fractions of mass – might be lost in the process. "Over the years, several official copies have been produced and distributed to various national metrology offices," says Ali Eichenberger, a physicist at the Swiss Metrology Office (METAS). "Although it is not yet possible to define the kilogram mass in an absolute way, modern technology makes it possible to compare different masses with very high precision, up to 1 microgram. Looking at the different official copies there seems to be a significant variation in masses." Moreover, not knowing the kilogram with the appropriate precision has an impact on other units, such as the ampère.

A metrology project launched by METAS in which CERN is participating should be able to fix the problem. The idea is to build an ultra-precise watt balance – an instrument that compares mechanical and electrical power (see box). Using the watt balance and its equations, it is possible to relate the unit of mass to the metre, the second and the Planck constant, i.e. to all fundamental units and constants.

"One of the crucial elements of the watt balance is the magnetic circuit, which needs to be extremely stable during the measurement," explains Davide Tommasini, a magnet expert from the Magnets and Superconductors group in CERN's Technology Department, who is directly involved in the METAS watt balance project. "By using a correctly dimensioned 'magnet shunt' with a low Curie temperature, it is possible to drastically reduce the effects of temperature variation. The circuit must also provide a very homogenous magnetic field in the whole volume involved in the measurement." The magnet circuit will be assembled at CERN. "We are expecting the permanent magnet and the 'shunting' cylinder to arrive soon. We will then work on testing the performance of the circuit," says Davide Tommasini.

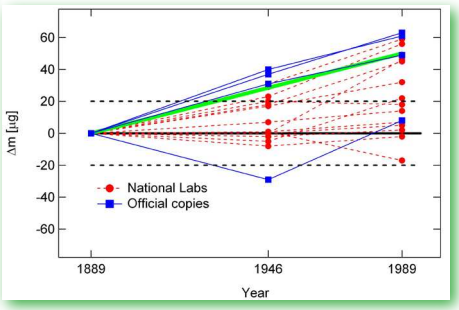
"The requirements associated with the magnets are very strict and we are very happy that CERN agreed to take part in the project in the framework of its knowledge transfer activities," says Henri Baumann, a physicist at METAS who launched the project together with Ali Eichenberger. "This measurement will also lead to a significant improvement in the determination of the Planck constant. The CERN theorists will be happy to know that!"

"This project is a clear indication of the impact that the skills and the expertise needed in particle physics have on other research domains and on society," says Hartmut Hillemanns from the KT group, who has fostered the project with the scientific team at CERN and led the negotiations with the other project partners.

The new definition of the mass unit should be available in a couple of years from now. Chances are that by then we will have also understood how mass is created at the most fundamental level… yes, we are talking about the Higgs this time!

Antonella Del Rosso

The watt balance built by METAS to perform previous measurements of the Planck constant. A new balance is currently under development. (Courtesy of METAS).



Over the past century, significant variation is seen between the masses of the official kilogram copies. (Courtesy of METAS).

Did you know?

The principle of the watt balance

The watt balance is an electromechanical instrument that measures the weight of a test mass very precisely. In the watt balance a coil is suspended on one arm and is immersed in a horizontal magnetic flux. During a first measurement phase, the current in the coil exerts a vertical force on the conductor that is balanced against the weight of the test mass. In the second phase, the coil is moved at a constant velocity through the magnetic field, and the voltage induced across the coil is measured. By combining the equations and performing various subsequent calculations one arrives at the equation:

$$m = C \cdot \frac{f_j \cdot f'_j}{g \cdot v} \cdot h$$

where C is a calibration constant, fj and f'j are the Josephson frequencies used during the static and the dynamic phase and h is the Planck constant. The watt balance experiment therefore allows the unit of the mass to be related to the metre, the second and the Planck constant.

Several watt balances are currently in operation around the world and are being used for metrology purposes.

Another way of fixing the problem

The most important alternative for defining the kilogram, known as the "X-ray crystal density" method or the Avogadro project, consists in accurately measuring the density of a very pure crystal silicon sphere.

CERN to start producing medical isotopes

A promising project that was hailed at the ICTR-PHE 2012 medical conference (see Bulletin issues 10-11/2012 and 12-13/2012) has seen the light of day at CERN. The project, known by the name of MEDICIS, will make it possible to produce a large variety of radioactive isotopes for medical research.

In the United States, a new radium-based drug which targets bone metastases is about to go on the market. Radium, which can be brought to bear at the cell level, is a potent weapon in the fight against certain types of cancer, and is opening the way to a new form of medicine. This is the direction that CERN has decided to follow through the CERN-MEDICIS* (Medical Isotopes Collected from ISOLDE) project.

Thierry Stora, leader of the CERN-MEDICIS project and of the Targets and Ion Sources Development Team at ISOLDE, explains: "At ISOLDE we have the capability to produce a thousand different radioactive isotopes. The objective of MEDICIS is to make use of the expertise and infrastructure of ISOLDE to produce radioactive isotopes that could be useful in medicine."

In ISOLDE, targets are bombarded with proton beams. Of the incident beams, only 10% are actually stopped in the targets and achieve their objective, while the remaining 90% are not used. By putting up a second target for MEDICIS behind the first one, a portion of the lost beams could be re-used. "This will allow us to produce isotopes specially for medicine, without interfering with ISOLDE's work," underlines Thierry Stora. Once the second target has been bombarded and the "medical" isotopes created, the sample will be transferred to a shielded cell in the ISOLDE laboratory, by means of a pneumatic transport system. "The transport system and the shielded cell will be funded from the Knowledge Transfer Fund" (see the article in Bulletin 04-05/2012), says a contented Thierry Stora.

When the sample reaches the shielded cell, an operator will start the process of extracting the radioactive isotopes. The highly purified isotopes will be formed into batches that can be sent to external laboratories that will use them for medical research. "CERN-MEDICIS is supported by the Hôpitaux Universitaires de Genève, the Centre Hospitalier Universitaire Vaudois (CHUV) in Lausanne and the cancer research institute ISREC of the École Polytechnique Fédérale de Lausanne. It will bring together cancer specialists, surgeons, experts in nuclear medicine, scientists and experts from ISOLDE: a real tiger team!" says an enthusiastic Stora.

This image of a brain, superimposed on a drawing by Leonardo da Vinci, was taken by a PET scanner after injecting a molecule containing a positron-emitting isotope. CERN-MEDICIS will produce new isotopes for imaging which will be able to show up cancerous tissues and destroy them by emitting local radiation as the isotopes decay.

In the future, MEDICIS is expected to join other European institutes specialising in the production of radioactive isotopes for medical research.

Anaïs Schaeffer

Producing isotopes

By bombarding a specific material with a proton beam, the experts from ISOLDE can modify its structure. When the nuclei of the atoms in the target material are broken apart, new elements are created—including radioactive isotopes.

There are three possibilities for breaking apart a nucleus. Fragmentation involves a small piece being broken off the nucleus, leaving a lighter nucleus. In fission, a heavy nucleus is split into two nuclei of intermediate mass. In spallation, finally, protons or neutrons are ejected, leaving behind a nucleus that is closely related to the original.

The target material can be of many different substances: titanium, lead, ceramic, etc. By choosing just the right target and method, ISOLDE can produce a wide range of different radioactive isotopes.

* *Note that the name "MEDICIS" has not yet been approved and may change.*

COMPASS spins in new directions

The COMPASS experiment is preparing for a new phase in its physics programme: COMPASS-II. Due to start in 2014, COMPASS-II will bring a powerful new look at the building blocks of protons: quarks and gluons.

It's an exciting and busy time for COMPASS. As one of the few experiments in the world capable of studying the internal structure of protons with high precision, COMPASS uses secondary beams from the SPS accelerator to study a variety of quark and gluon properties. This includes their distribution within nucleons, their contribution to nucleon spin and the way they form hadrons when pulled out from the nucleon - all properties that may also improve the understanding of proton collisions in the LHC.

In 2014, a new chapter will begin for the COMPASS collaboration. "We have two new phases planned for COMPASS-II," explains Fabienne Kunne, COMPASS co-spokesperson. "The first will begin in 2014, colliding 190 GeV negative pion beams into a polarised target. This will allow us to make the first polarised measurements of the Drell-Yan process."

The COMPASS installation.

The Drell-Yan process occurs when a quark and an antiquark annihilate at high energies, producing two leptons in the final state. Using measurements of the azimuthal distribution of particles in this process, the COMPASS collaboration will look for differences with previous COMPASS studies in order to test current Standard Model theory. To accomplish these measurements, COMPASS will be moving the polarised target further upstream of the beamline and inserting an absorption medium behind it to track the muon pairs that dominate the collisions.

"The second phase of COMPASS-II will begin in 2015 and will focus on gathering a kind of 3D picture of the nucleon," says Andrea Bressan, COMPASS co-spokesperson. "By analysing the general distribution of particles inside the nucleon and taking account of their spin and transverse momentum, we hope to gain a new understanding of the internal dynamics of the nucleon. We also hope to gather the first understanding of the quark orbital angular momentum, which has yet to be measured."

For this study, the collaboration will use 160 GeV muon beams and a new liquid-hydrogen target. This target is currently being constructed by CERN's Cryogenics Group (TE) and will be installed in September 2012. "We will be conducting a pilot run of this new set-up, gathering preliminary data to ensure the 2015 run goes as smoothly as possible," concludes Fabienne.

Katarina Anthony

CERN HR receives award for on-line recruitment and communication

In a survey of 21,000 European students, CERN ranked 15th, ahead of giants like Microsoft and Nestlé, for the quality of its on-line "talent communication", that is how it uses the Internet to attract job applicants. HR now boasts a new virtual award, certifying its on-line savvy.

How did you get your job at CERN? Via the CERN HR website, or Facebook, or Twitter? Or were you head-hunted on LinkedIn? Particularly if you're from the younger generation, chances are that you used some form of on-line recruitment. In this case you will have used one of the best recruitment tools in Europe, according to the 2012 OTaC (Online Talent Communication) study, carried out by a research institute named Potentialpark. It surveyed over 21,000 students, asking them to rate employers' use of seven different channels of communication about jobs and careers, from HR websites and on-line application systems to their Facebook, Twitter and LinkedIn pages, and their blog presence in the careers field. "The only channel where CERN didn't get a good rating was for mobile phone use, because we don't have an app yet!" laughs James Purvis, head of Recruitment. "But our Facebook careers page ranks 10th in Europe, and our Youtube presence is very strong too."

The "virtual" award given to HR.

So what is CERN doing right, and how did the HR team get that good? "We went looking for the data," explains Leila El Baradei, a recruitment sourcing specialist in HR. "We initially decided to improve our website a couple of years ago, so we commissioned a study by expert evaluators and then followed much of their advice. Some of it was omissions, like not explaining the application and interview procedure, but we also got input about things like corporate branding, and from there developed our strap line "Take part". Now all our communications about jobs and careers have the same look and feel."

"Gone are the days when you could dictate your brand," comments James. "Today every company or organisation has a brand out there, whether they like it or not, because everybody is producing content on the web now. So we have to make sure we are in the arena influencing the brand."

The HR team has seen palpable results from its improved talent communication. "In the past, we got an average of 30 to 50 applications for each post," says Leila. "Today it can be anywhere between 100 and 300." "It's down to a real team effort: there's not just one person behind it," concludes James. "Everybody in the team is really proud of what they're doing and it's great that we're seeing some recognition in the form of this award."

Joannah Caborn Wengler

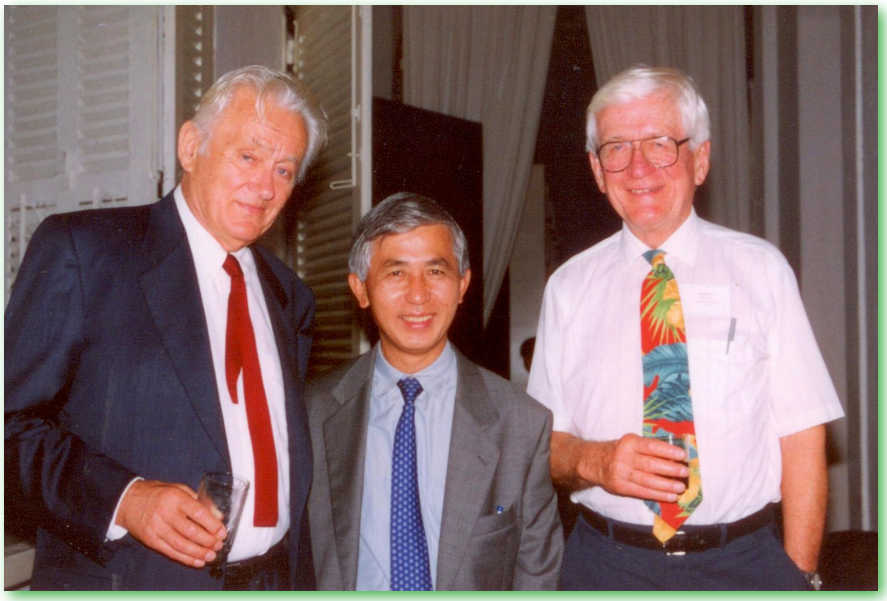
The inventor of the "Rencontres"

Jean Trân Thanh Vân is the founding father of the "Rencontres de Moriond", one of the most widely anticipated annual physics conferences throughout the world. Important results are presented every year. After Moriond, Jean Trân Thanh Vân went on to set up the "Rencontres de Blois", then the "Rencontres du Vietnam" in the country from which he originates. In 2013 a completely new conference centre will be inaugurated at Quy Nhon (Vietnam). Yet another project launched by Jean Trân Thanh Vân.

We met Jean Trân Thanh Vân at the "Rencontres de Moriond", 2012. Founded in 1966, this conference has been held only once in Moriond, the former name of Courchevel 1650, a popular skiing resort in France. "While I was writing my doctoral thesis, I felt a strong need to bring experimental and theoretical physicists together for informal exchanges in a relaxing context conducive to creative ideas. During the winter of 1966, some 30 physicist friends met at Moriond, where, after some working sessions, we did some downhill skiing together. In this relaxed and constructive atmosphere we had lots of ideas for collaboration. Over the years other physicists joined us and it was thus that the "Rencontres de Moriond" were born."

Initially held in mountain chalets where they did the cooking together, then in a hotel at the resort for practical reasons, the "Rencontres" finally ended up at La Thuile in Italy in 2004. "The basic principle behind the "Rencontres" is the concept of intensive work carried out in a relaxed atmosphere. So we tried to link Moriond to the idea of doing sport and Blois to the idea of visiting historic and cultural landmarks", explains Jean Trân Thanh Vân. The "Rencontres de Moriond" were initially devoted to particle physics but were extended to include biology in 1970, astrophysics in 1981 and then nanophysics in 1994.

The main asset of the "Rencontres" is the mix of theoretical and experimental scientists. This means that immediately after a presentation of the latest experimental results on a topic, you get the possible interpretations from a theorist. "Participants often respond spontaneously to presentations, with the result that important conclusions are presented at Moriond for the first time," confirms Bolek Pietrzyk, organiser of Moriond QCD, one of the components of the conference which is now broken down into several sessions, such has been its success. "The spirit of Moriond also implies that the presentations be made by young people. Here again the mix is fruitful."



Jean Trân Thanh Vân with Georges Charpak (left), 1992 physics Nobel prize, and Norman F. Ramsey (right), 1989 physics Nobel prize.

In 1989, 23 years after the first "Rencontres de Moriond" were held, Jean Trân Thanh Vân decided to mix science with culture and instituted a series of interdisciplinary conferences in the spectacular historic surroundings of the Château de Blois, a jewel of Renaissance architecture. Thus the "Rencontres de Blois" were born. In 1993 came the "Rencontres du Vietnam", in hommage to Jean Trân Thanh Vân's country of birth. Since then Jean Trân Thanh Vân has been working on a project for an international centre for science and education in Vietnam. "The aim of the project is to create a seedbed for scientific and educational development," explains Jean Trân Thanh Vân. There is a very large population of young people in Vietnam and remarkable economic development. Scientific training and education must remain a priority in the process of development."

The centre will have the latest facilities for organising international conferences. The project could be extended to include a planetarium, an hotel and an engineering school. "It will have taken almost 20 years to implement this project but now we're nearly there!" explains Jean Trân Thanh Vân enthusiastically. And if you think that that's the end of the story, you would be wrong: Jean looks like somebody who has just started work. He's already dreaming of other projects and, as he says, "sooner or later you can achieve wonderful things if you believe they can happen." How old is he? You can be sure he's still very young.

Antonella Del Rosso

For more information on the International Centre for Interdisciplinary Science and Education (ICSE) and its programme of scientific conferences in 2013:

http://rencontresduvietnam.org/?page_id=230

Jean Trân Than Vân was recently awarded the prestigious Tate Medal by the American Institute of Physics.

Official web site of the "Rencontres de Moriond":

http://moriond.in2p3.fr/

“Accelerating Science” exhibition zooms to Turkey

‘Accelerating Science’, CERN’s travelling science outreach exhibition, has just arrived at the Middle East Technical University (METU) in Ankara, Turkey for a four-month stay there. This is the first time it has moved outside the circle of the Member States. The Turkish venue will inaugurate some new exhibits that have recently been developed by CERN’s software developers.

“It’s been a very busy day,” says Bilge Demirkoz, an associate professor of physics at METU and a member of AMS-02, who had been overseeing the unloading of the lorries when we spoke to her. “As the University doesn’t have a specific exhibition space, the CERN exhibits are going to be housed in the covered tennis courts just behind the cultural and congress centre. It’s a beautiful venue, and there are plenty of parking spaces.”

The University has sent invitations to the exhibition to high schools and to about 100 Turkish universities with physics departments. Bilge and her colleagues are also launching a media campaign, including a new website (in Turkish), to encourage the general public to come. “There’s a lot of interest in the search for the Higgs here, but also a lot of misunderstanding about particle physics,” explains Bilge. “So the Department of Physics here really wanted the exhibition to come to Turkey to clear up some of that misunderstanding. It’s also important in the context of Turkey’s ongoing negotiations concerning its future status at CERN.” “We are very pleased to host the CERN exhibition at our Ankara Campus. I trust it will help students and lay people of all ages to better understand the nature and significance of CERN research,” adds Ahmet Acar, President of METU.

The exhibition has recently been enriched with some new animations and hands-on displays that will be shown in Turkey for the first time. “We’ve been working on a new interactive exhibit called ETAPE, which stands for the Energy Timeline of Accelerators and Particle Experiments,” explains Joaõ Pequenaõ, a multimedia developer from the CERN Media Lab. He and Henrique Carvalho, a Portuguese student from LIP Minho, have been working on the software for the exhibit, while Joaõ Bárcia, also from the Media Lab, is responsible for the innovative touch-screen hardware in the device. On two huge touch-screens, visitors will be able to select a particle physics accelerator based on its position on an ‘energy timeline’ designed to demonstrate how collisions in new accelerators have become more and more energetic. “Press the ‘Hit’ button and a 3D animation of a particle collision appears on the screen, revealing which energies are needed to produce which particles,” explains Joaõ Pequenaõ.

Preparations are in full swing for the grand opening of the exhibition on 2 April, which will be attended by CERN’s Director-General, Rolf Heuer, and Emmanuel Tsesmelis, CERN’s Advisor for Turkey. “Such exhibitions offer a significant opportunity for a greater public understanding of CERN and of its objectives in the areas of science, technology, education and international collaboration. This particular exhibition will be another important step in bringing Turkey and CERN closer together,” underlines Emmanuel.

Joannah Caborn Wengler

Different way, same goal

Radio-oncologists and radiotherapists represented a large proportion of the doctors and clinicians who attended the ICTR-PHE 2012 conference. With them were also biologists and doctors of nuclear medicine. They presented the state of the art of their research that touches on the genetics and biology of tumours as well as on futuristic drugs that selectively target malignant cells. The future of cancer treatment seems to lie in the personalised approach.

When the members of the life sciences community took over from the physicists, the focus remained basically the same. Just another sign of the fact that the different communities are leading the same battle and have the same goal. However, the methodologies and issues can be very different.

The example of hadrontherapy illustrates the situation well: while for physicists this is a relatively well-established concept, medical doctors consider that the amount of patient data available is still very small. Several clinical trials are in progress but conclusive results will not be available for many years.

One of the weapons against cancer that biology can provide radiotherapy with is biomarkers, substances that, once injected into the body, can provide information about the metabolism or, more generally, the functioning of specific cells. The role of genetics and the effects of radiation on vital organs such as the heart or the lungs were discussed in depth at the ICTR-PHE 2012 conference. These studies could help understand why some tumours are radio-resistant, why some patients do not respond to therapy and why some clinical strategies that look foolproof on paper cannot always be used in patient treatment.

Another area where the role of life sciences is becoming crucial in the fight against cancer is in understanding the molecular mechanisms that lead cells into the hypoxic state. We know that malignant cells exposed to radiation can be more effectively damaged if oxygen is present, because oxygen is strongly reactive. However, in advanced tumour states, cells become hypoxic, i.e. they receive less oxygen, and therefore become more resistant to radiotherapy. Understanding the cascade of molecular mechanisms underlying these cell processes would certainly help doctors to develop more effective treatments. At the conference, speakers presented the case of the so-called "bioreductive cytotoxins" – new molecules currently under study that play a role in the response of hypoxic tissue to radiotherapy.

A great many molecules are currently being studied by scientists for the development of new drugs, new radiotracers and new radioprotectors. However, they do not seem to work in the same way in all situations. In other words, what seems to play a crucial role is the specific biological system in which these drugs are used. Every cancer, every structure of the neoplastic tissue, and above all every patient is unique. Understanding these differences can help to achieve a better response to therapy and to reduce toxicity and side effects, thereby decreasing healthcare costs and saving resources. This means that, although at the moment there is a generalised consensus that the combination of different therapies – surgery, radiotherapy and chemotherapy – is the best way to cure patients, doctors also have to take genetics and biodiversity into account in order to improve outcomes.

Several speakers emphasised once again the important role of the interdisciplinary approach. Merging state-of-the-art imaging, the latest findings in clinical medicine and pharmacology, high-tech radiotherapy and effective clinical trials are the key to success. However, such a merger is no trivial issue and cannot be achieved overnight. Meetings such as ICTR-PHE 2012 are vital to fostering these valuable dynamic exchanges.

Antonella Del Rosso & Fabio Capello

Helix Nebula: sunshine and clouds on the CERN computing horizon

23 petabytes is how much data CERN recorded during 2011, and this number will rise in 2012. In order to respond to the challenge, the IT department is upping its game, amongst other things by participating in the Helix Nebula project, a public-private partnership to create a European cloud-computing platform, as announced in a recent CERN press release.

"We're not replacing the Grid," clarifies Bob Jones, responsible for CERN openlab who is also responsible for EC-funded projects in IT, "but looking at three complementary ways of increasing CERN's computing capacity, so that as demand goes up we can continue to satisfy our users."

"First we are upgrading the electrical and cooling infrastructure of the computer centre in order to increase the availability of critical IT services needed for the Laboratory. This will also provide more floor space in the area called The Barn, allowing for more servers to fit in."

"The second," he continues, "involves hosting CERN servers in a remote data centre in another Member State, probably as soon as 2013. There's been an official tendering process, the results of which should be announced later this month."

"Thirdly, there's cloud computing, with the Helix Nebula project," announces Bob, sitting up. "We're testing it using ATLAS simulation software and plan to expand the testing to more experiments in the future. It's a radically new way of providing computing resources. Instead of procuring the hardware and then maintaining and managing it, we procure the service from a commercial infrastructure provider within the Helix Nebula partnership, providing network access, storage and CPU." The other thing he likes about the system is its flexibility. "It's a pay-as-you-go scheme," he explains. "So you only pay for the resources you actually use."

The first two years of the project are a pilot phase, in which performance issues like functionality and reliability will be tested, and questions like applicable legislation in relation to the use of cloud services not physically located on the CERN site. The costing needs to be understood too, and CERN, with the two other international organisations involved (the European Molecular Biology Laboratory (EMBL) and the European Space Agency (ESA)), needs to address confidentiality and privacy issues in relation to cloud computing.

"EMBL and ESA deal with patient information and sensitive geophysical data, so they have additional security concerns," explains Bob. "This is why the project serves as a testing ground, because it covers many different potential uses. Then, when the various issues have been resolved, the system should be fit to be rolled out to national institutes in what is known as the European Research Area."

Joannah Caborn Wengler

e-EPS Facts and Info from the European Physical Society

e-EPS News is a monthly addition to the CERN Bulletin line-up, showcasing articles from e-EPS – the European Physical Society newsletter – as part of a collaboration between the two publications.

Highlights from e-EPS: Gender Manifesto / Energy Conference / ERASMUS Anniversary

Manifesto on the Gender Dimension in Research

Interested parties are encouraged to sign the Manifesto for Integrated Action on the Gender Dimension in Research and Innovation. The manifesto discusses potential actions to enhance research and innovation by addressing gender equality issues.

The manifesto follows on from the European Commission public consultation on the green paper "What actions should be taken at EU level to further strengthen the role of women in science and innovation?", which received 300 responses, and the subsequent 2011 European Gender Summit, which was attended by over 400 stakeholders.

To date, over 2,800 people have signed the manifesto. For more information, and to sign the manifesto, please visit the gender summit website:

http://www.gender-summit.eu/

Second European Energy Conference

The Second European Energy Conference (E2C) is being held at the Maastricht Exhibition & Congress Centre, in the Netherlands, on 17-20 April this year. The event, part of a bi-annual series, will act as a forum for the discussion and definition of the role of energy science and research in the future European energy system.

The conference programme will consist of morning plenary lectures, covering overarching subjects of energy and associated climate research, with afternoon symposiums focusing on the essential key fields in the development of our future energy system. The conference will conclude with a panel discussion on the European dimension of research and development.

For more information, and for registration, please visit the conference website:

http://www.energy-conference.eu/

ERASMUS programme celebrates 25th anniversary

2012 marks the silver anniversary of the European Community Action Scheme for the Mobility of University Students (ERASMUS), the European Union's best known and most popular student exchange programme.

In commemoration of this milestone a series of national festivities, to be held throughout the year, were announced at the end of January by the European Commissioner for Education, Culture, Multilingualism and Youth, Androulla Vassiliou.

Close to three million students have benefited from a study period or work placement abroad since the establishment of the programme in 1987.

Hendrik Ferdinande and Ian Randall

NEW ARRIVALS

On Tuesday 20 March 2012, in the second part of the Induction Programme, members of the CERN Management welcomed recently recruited Staff Members and Fellows (photographed here with Jean-Marc Saint-Viteux, Deputy Head of HR Department, and Vincent Vuillemin, CERN Ombuds).

HR Department

Ombuds' Corner
Le coin de l'Ombuds

In this series, the Bulletin aims to explain the role of the Ombuds at CERN by presenting practical examples of misunderstandings that could have been resolved by the Ombuds if he had been contacted earlier. Please note that, in all the situations we present, the names are fictitious and used only to improve clarity.

Code of Conduct and change of behaviour

Is our Code of Conduct actually effective in influencing behaviour? Research studies suggest that codes, while necessary, are insufficient as a means of encouraging respectful behaviour among employees. Codes are only a potential means of influencing employee behaviour.

For a Code of Conduct to be effective, several elements must be in place. Firstly, there needs to be communication and effective training using relevant examples to make the code real. It should be embraced by the leaders and accepted by the personnel. Finally, it should be embedded in the CERN culture and not seen as a separate entity, which requires serious discussions to raise awareness. In addition, every code must be assessed on its real success (or failure) in changing behaviour to create a more respectful workplace environment.

Another factor which determines the effectiveness of a code of conduct is the degree to which code violations can be appropriately sanctioned, and to which extent people conforming to the code are rewarded. Not to forget the most important element: the active and visible support from the management.

Everyone is responsible for fostering a culture of respect and leaders should be held to account for their teams, in the same way that they are held to account for them in terms of technical efficiency, scientific excellence and deliverables. The Code of Conduct should be considered as a key strategic document by everyone in our Organization, otherwise it will simply remain window dressing.

Greg* leads a CERN unit involved in the operation of the accelerators and the experiments. His technical knowledge is recognised by everyone, so his management is considering giving him a big promotion, that Greg by the way expects. However, Greg is known by his colleagues and subordinates to spread rumours and make remarks about people, which lowers the morale of his team and spoil the overall atmosphere. Several people suffer from his lack of courtesy and low level of tolerance. Essentially Greg believes that he is the best and that the others are not up to his level. Of course his collaborators resent that strongly and think that some action should be taken by his hierarchy to stop such behaviour. It seems that Greg's possible promotion would be felt by everyone on the team as an offense, as if he were the only one who works hard. They have often enough heard Greg using that kind of language.

The management on the other hand is preoccupied that if Greg does not get his promotion, he will take it as a slap in the face and this could endanger operations. The dilemma is obvious. Should someone who is important for his technical expertise but who violates the Code of Conduct be given a promotion? That is where the question of the culture of the Organization comes into play.

If the culture values scientific results above all else, then Greg will most likely get the promotion and the hierarchy will think that the rest can be worked out somehow through training, coaching or mentoring. His collaborators will then be most offended, spreading the word that the Organization does not care about its own Code of Conduct. Much trouble can be expected in the unit, maybe even endangering operations.

If the culture values ethics more, Greg will probably not be given his promotion this year. He may not understand the reason why and could spread his strong opinion that CERN, as a scientific laboratory with a global reputation, does not recognise technical excellence.

The best route to take is the one where both scientific and ethical cultures are taken into account. So the Code of Conduct should be an essential part of the CERN culture. In the case study presented, other means are available, such as transparent communication, open and truthful explanations, feedback methods, so that a satisfactory solution can be found for all those involved. Finding such a solution cannot be more complicated than building the LHC, so it is possible to reach it with a positive attitude and willingness to act!

Conclusion

It is not obvious that by itself the Code of Conduct can change people's behaviour to create a respectful workplace environment. A great deal of follow-up in the various groups and units is required for that. This is a challenge that we all have to face. Given the fact that challenges are part of our every work day, if we take this one on, we will undoubtedly succeed.

Contact the Ombuds early!

http://cern.ch/ombuds

Vincent Vuillemin

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* *Names and story are purely fictitious.*

Take note

CERN RESTAURANT OPENING TIMES DURING THE EASTER WEEKEND

Restaurants 1 and 3 will be closed from Friday 6 April to Monday 9 April 2012 inclusive.

Restaurant 2 will be open from 8.30 a.m. to 8.00 p.m. on Friday 6 April 2012 and from 9.00 a.m. to 8.00 p.m. on Saturday 7 April, Sunday 8 April and Monday 9 April 2012.

Hot meals will be served from 11.30 a.m. to 1.30 p.m. and from 6.00 p.m. to 7.30 p.m.

FP Department

GLOBAL INET 2012: MEETING AT THE CROSSROADS: IMAGINING THE FUTURE INTERNET

Global INET 2012 will take place at the CICG on April 22-24 to discuss the topics and challenges that will shape the future of the Internet. This is an excellent opportunity to meet with, network and learn from top Internet technologists, policymakers, business executives and other individuals from around the globe. The conference boasts a programme of over 50 speakers and panelists, all offering their insights into topics such as internet governance, law, ecosystems, intellectual property, social networking and the link between the internet and economic transformation. Panelists include Slim Amamou, Lynn St Amour, Vint Cerf, Lesley Cowley, Steve Crocker, Dr. Leonard Kleinrock, and co-founder of the Campus Party Paco Ragageles, as well as the CERN Director General, Dr. Rolf Heuer.

As there are too many panelists to mention them all, please visit our website:

http://www.internetsociety.org/events/inet-conferences/global-inet-2012?utm _source=CERN&utm_ medium=email&utm_ campaign=Global%2BINET

Don't delay and register today for Global INET 2012!

AMFIE INFORMATION MEETINGS

Meetings open to all members of personnel (users, staff, etc) as well as retired staff.

Public presentation with question/ answer session, Wednesday 18 April 2012, from 12:00 to 13:00, in room 40-2-A01.
Private consultations on appointment, Wednesday 18 April 2012, from 10:00 to 11:30 and from 14:00 to 17:30, in room 5-5-028

AMFIE is a cooperative society open exclusively to international civil servants. It is managed by a group of active and retired international civil servants. Created in 1990 as a fully licensed financial institution, it is subject to the laws and regulations which govern the activities of Luxembourg's financial sector. The Cooperative offers its members a broad range of financial services and products at little or no cost in the six currencies available to account holders (EUR, CHF, GBP, USD, CAD, AUD).

More information:
http://indico.cern.ch/conferenceDisplay.py?confId=184151

HR Department
Tel. 74125

SUMMER WORK FOR CHILDREN OF MEMBERS OF THE PERSONNEL

During the period from 18 June to 14 September 2012 inclusive, there will be a limited number of jobs for summer work at CERN (normally unskilled work of a routine nature), which will be made available to children of members of the personnel i.e. anyone holding an employment or association contract with the Organization.

Candidates must be aged between 18 and 24 inclusive on the first day of the contract, and must have insurance cover for both illness and accident. The duration of all contracts will be 4 weeks and the allowance will be CHF 1717.- for this period. Candidates should apply via the HR Department's electronic recruitment system (e-RT) at:

https://ert.cern.ch/browse_www/wd_portal.show_job?p_web_site_id=1&p_web_page_id=10220

Completed application forms must be returned **by 10 April 2012 at the latest.** The results of the selection will be available by the end of May 2012.

For further information, please contact: Virginie.Galvin@cern.ch

HR Department
Tel. 72855

Safety Training Course

"USE OF FIRE EXTINGUISHERS": A NEW COURSE WITH A NEW SIMULATOR

A new training course, "Handling of fire extinguishers", is available since the beginning of March 2012.

The training course is given by members of CERN's Fire Brigade (GS-FB) and is intended for all members of personnel of CERN.

Upon successful completion of the training course, you will be able to do the following:

- recognise a potentially combustible item and the various fire classes;
- choose the appropriate extinguisher for a given fire class;
- handle a fire extinguisher properly and efficiently;
- apply CERN's safety instructions.

An important part of the training are the different firefighting exercises conducted using a new simulator, which makes it possible to simulate real conditions such as the following:

- a fire in the office;
- a fire in an electrical cabinet;
- a fire involving chemicals.

Don't wait: sign up for the training course directly through the CERN Training Catalogue:

Course code 077YY00 – Use of fire extinguisher – live exercises

The dates of forthcoming sessions are posted in the CERN Training Catalogue.

The course will be offered in French and English.

For more information, contact the Safety Training team (HSE Unit) directly by sending an e-mail message to safety.training@cern.ch.

Photos of the training session for self-rescue mask instructors held on 21 March 2012 – 10 new instructors followed the coursePhotos of the training session for self-rescue mask instructors held on 21 March 2012 – 10 new instructors followed the course

NEW REFRESHER TRAINING IN THE USE OF SELF-RESCUE MASKS

A refresher course in the use of self-rescue masks has been added to the CERN training catalogue.

Sign up!

More than 3500 people have followed the course since it was introduced in 2009.

Taking account of the forthcoming long shutdown, requests for follow-up training from course participants and recent changes in the course content, the HSE Unit has decided to place a three-year limit on the validity of the initial training and to introduce a refresher course.

The new refresher course is open to all personnel having completed the initial course at least 2 years ago.

The course, "Recyclage Formation masque auto-sauveteur » / "Refresher course Self-Rescue Mask Training", (code No. 077Y00R) is already available from CERN's training catalogue.

The first sessions are scheduled for April 2012.

The course will be offered in French and English and, like the initial course, will comprise both theory and practical sessions, including simulations under real conditions.

The Safety Training team anticipates a significant increase in requests for training before and during the first long shutdown known as LS1. You are therefore recommended to sign up for a course well in advance of the start of the shutdown if the validity of your training expires within the next year.

Please note that the Safety Training Service will send a reminder to all those whose initial training is due to expire during LS1.

If you are unsure when you followed the initial course, you can find the date in the HRT application (https://hrt.cern.ch/hrt/Training).

Safety Training Team

Academic training

2, 3, 4 and 5 April 2012

ACADEMIC TRAINING LECTURE
Regular Programme

from 11:00 to 12:00 - Bldg. 222-R-001 - Filtration Plant

Statistical Methods for Particle Physics

by Glen Cowan (Royal Holloway)

The series of four lectures will introduce some of the important statistical methods used in Particle Physics, and should be particularly relevant to those involved in the analysis of LHC data. The lectures will include an introduction to statistical tests, parameter estimation, and the application of these tools to searches for new phenomena. Both frequentist and Bayesian methods will be described, with particular emphasis on treatment of systematic uncertainties. The lectures will also cover unfolding, that is, estimation of a distribution in binned form where the variable in question is subject to measurement errors.

11, 12 and 13 April 2012

ACADEMIC TRAINING LECTURE
Regular Programme

from 11:00 to 12:00 - Main Auditorium, Bldg. 500

Neutrinos

by Antonio Ereditato / Universitaet Bern (CH)

Organiser: M. Prola-Tessaur / PH-EDU

Safety Training Course

SAFETY TRAINING: PLACES AVAILABLE IN APRIL

There are places available in the forthcoming Safety courses. For updates and registrations, please refer to the Safety Training Catalogue.

If you are interested in attending any of the below courses, please talk to your supervisor, then apply electronically via EDH from the course description pages, by clicking on SIGN-UP.

Registration for all courses is always open – sessions for the less-requested courses are organized on a demand-basis only. Depending on the demand, a session will be organised later in the year.

April 2012

Alphabetical order (original course titles are maintained)

Noise - Understanding the risks

18-APR-12, 10.00 – 12.30, in French

Conduite de chariots élévateurs / Driving of forklifts

23-APR-12 to 24-APR-12, 09.00 – 17.30, in French (with possibility to have the handouts in English)

First-aiders – Basic course

23-APR-12 to 24-APR-12, 08.30 – 17.30 and 08.30 – 12.30 (total: one day and a half), in French

First Aiders - Refresher Course

24-APR-12, 13.30 – 17.30, in French

Habilitation électrique personnel non électricien / Habilitation électrique for non electricians

02-APR-12 to 03-APR-12, 09.00 – 17.30 and 09.00 – 12.30 (total: one day and a half), in French

Manipulation d'extincteurs : exercices sur feux réels / Use of fire extinguisher – live exercises

02-APR-12, 13.30 – 15.30, in French

11-APR-12, 13.30 – 15.30, in French

Radiological Protection

02-APR-12, 08.30 – 12.30, in English

23-APR-12, 13.30 – 17.30, in English

27-APR-12, 08.30 – 12.30, in English

Recyclage – Habilitation électrique personnel électricien en basse tension / Refresher course for electricians low voltage

03-APR-12 to 03-APR-12, 13.30 – 17.30 and 09.00 – 17.30 (total: one day and a half), in French

Risques liés aux interventions en espace confiné / Confined spaces

24-APR-12, 09.00 – 17.30, in French

Sécurité Radiologique / Radiological Protection

02-APR-12, 13.30 – 17.30, in French

27-APR-12, 13.30 – 17.30, in French

Self-rescue mask training

03-APR-12, 08.30 – 10.00, in French

03-APR-12, 10.30 – 12.00, in English

05-APR-12, 08.30 – 10.00, in French

05-APR-12, 10.30 – 12.00, in English

10-APR-12, 08.30 – 10.00, in French

10-APR-12, 10.30 – 12.00, in English

Isabelle Cusato (HSE Unit)

Seminars

MONDAY 2 APRIL

INDUCTION SESSIONS
8:30 - Bldg. 593-R-011

Induction Programme - 1st Part

ACADEMIC TRAINING LECTURE REGULAR PROGRAMME
11:00 - Bldg. 222-R-001 - Filtration Plant

Statistical Methods for Particle Physics (1/4)

G. COWAN / ROYAL HOLLOWAY

CERN COMPUTING COLLOQUIUM
14:00 - Salle Dirac Bldg. 40/S2-D01

Seeing Beyond the Cloud: New Applications, Opportunities, and Challenges in a Cloud-Centric World

N. BORENSTEIN / CHIEF SCIENTIST AT MIMECAST

GLOBE
20:30 - 1st Floor

Dr H, Leben und Tod der Eierkuchen

H. BUCHHOLZ

TUESDAY 3 APRIL

ACADEMIC TRAINING LECTURE REGULAR PROGRAMME
11:00 - Bldg. 222-R-001 - Filtration Plant

Statistical Methods for Particle Physics (2/4)

G. COWAN / ROYAL HOLLOWAY

EP SEMINAR
11:00 - TH Auditorium, Bldg. 4

First final results from CDF RunII

G. PUNZI / PISA UNIVERSITY AND INFN

TH STRING THEORY SEMINAR
14:00 -TH Auditorium, Bldg. 4

Conformal Regge Theory

J. PENEDONES / PORTO

GLOBE
20:30 - 1st Floor

Dr H, the life and death of pancakes

H. BUCHHOLZ

WEDNESDAY 4 APRIL

ACADEMIC TRAINING LECTURE REGULAR PROGRAMME
11:00 - Bldg. 222-R-001 - Filtration Plant

Statistical Methods for Particle Physics (3/4)

G. COWAN / ROYAL HOLLOWAY

SPSC MEETINGS
9:00 - Cooucil Chamber, Bldg. 503

SPSC News from Experiments and Projects at the PS and SPS - 105th Meeting of the SPSC

TH COSMO COFFEE
11:00 - TH Auditorium, Bldg. 4

TBA

E. LIM / DAMTP, CAMBRIDGE

TH THEORETICAL SEMINAR
14:00 -TH Auditorium, Bldg. 4

Symmetries of the primordial perturbations

P. CREMINELLI / ICTP, TRIESTE

GLOBE
20:30 - 1st Floor

Dr H, vie et mort des crêpes

H. BUCHHOLZ

THURSDAY 5 APRIL

ACADEMIC TRAINING LECTURE REGULAR PROGRAMME
11:00 - Bldg. 222-R-001 - Filtration Plant

Statistical Methods for Particle Physics (4/4)

G. COWAN / ROYAL HOLLOWAY

COLLIDER CROSS TALK
11:00 - TH Auditorium, Bldg. 4

Higgs->bb Searches with ATLAS, CMS and at the Tevatron

G. PIACQUADIO, G. J. FACINI / CERN , N. MOHR / ETH ZURICH (CH)

TUESDAY 10 APRIL

TH STRING THEORY SEMINAR
14:00 -TH Auditorium, Bldg. 4

Quantum kinetic theory at strong coupling from gravity

A. MUKHOPADHYAY / LPTHE, PARIS

WEDNESDAY 11 APRIL

ACADEMIC TRAINING LECTURE REGULAR PROGRAMME
8:00 - Main Auditorium, Bldg. 500

Neutrinos (1/3)

A. EREDITATO / UNIVERSITAET BERN (CH)

TH THEORETICAL SEMINAR
14:00 - TH Auditorium, Bldg. 4

TBA

B. SCHELLEKENS / NIKHEF

THURSDAY 12 APRIL

ACADEMIC TRAINING LECTURE REGULAR PROGRAMME
8:00 - Main Auditorium, Bldg. 500

Neutrinos (2/3)

A. EREDITATO / UNIVERSITAET BERN (CH)

FRIDAY 13 APRIL

ACADEMIC TRAINING LECTURE REGULAR PROGRAMME
8:00 - Main Auditorium, Bldg. 500

Neutrinos (3/3)

A. EREDITATO / UNIVERSITAET BERN (CH)