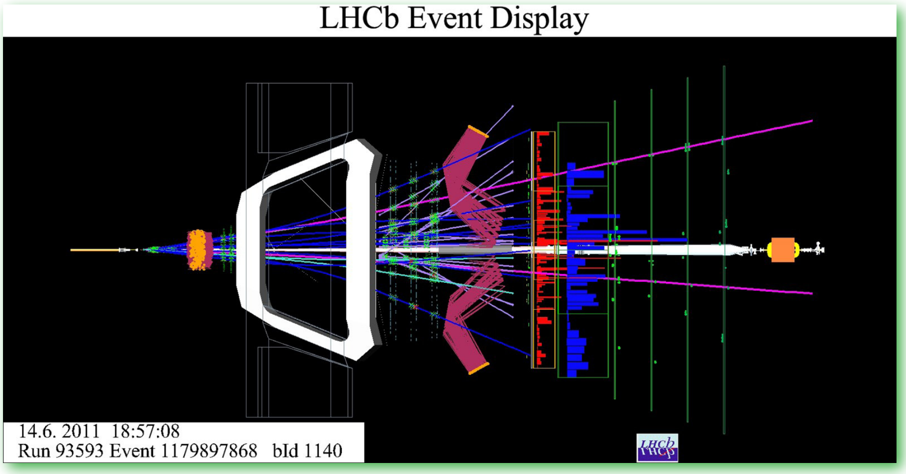
CERN Bulletin

Nos 32, 33 & 34 – 10, 17 & 24 August 2011

LHCb: full-steam strategy pays off



Event display presented at the EPS-HEP 2011 conference showing a B^0_s meson decaying into a μ^+ and μ^- pair.

LHCb looks at LHC proton collisions from a special angle. The experiment studies rare decays of the B particle to look into the physical processes that might hide new physics. Designed to operate at moderate luminosity, LHCb has been more daring for the last year and is running at conditions tougher than the nominal. The new strategy is paying off, as important physics results have just started to emerge…

The LHCb detector was originally designed to run at moderate luminosity and low interaction pile-up. In other words, unlike the CMS and ATLAS experiments, the whole LHCb experimental set-up and data-taking infrastructure was designed to process just one proton interaction for each bunch crossing.

For the last year, however, this has all been old news. A change in LHCb strategy was made possible when it became clear that the LHC was going to first increase the number of protons in the bunches and only afterwards increase the number of bunches in the machine. "Had we continued with the old policy last year and this year, we would have collected five times less data," says Richard Jacobsson, LHCb run coordinator. "Very soon we realized that the detector was actually able to stand much tougher operating conditions and could cope with more than just one interaction per bunch crossing. With the proton-rich bunches that the LHC was sending us, we saw that we could even process as many as six interactions per bunch crossing."

With such a high luminosity per bunch in July last year, all sub-detectors had to prove once again their ability to perform as expected. "Basically we saw that the whole detector was illuminated and we were saturating everywhere, up to the optical fibres for the data transmission. Actually, the trigger challenge required heroic efforts when our online computer farm also became saturated!" explains Richard. "However, we

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A word from the DG

Schools out – but not at CERN

For schools around the world, summer is a time of relaxation, but not at CERN. This is the time of year that summer students descend on us from around the world, giving the lab a refreshing summertime rejuvenation.

This year, we had over 1700 applicants for the 255 places available, and we have a nationality distribution as diverse as that of the laboratory itself, with students coming from 66 different countries. The summer student programme is long-standing tradition for CERN, and a great opportunity for the young

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In this issue

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LHCb: full-steam strategy pays off

(Continued from page 1)

could also see that, overall, the detector was perfectly capable of withstanding these extreme conditions."

The problem of saturation was particularly evident for the offline event reconstruction and analysis. With a higher pile-up the events become 'dirtier' – that is, more particles come into play at a given time, which makes it increasingly difficult for researchers to separate the interesting events from the background. "At the end of 2010 it became clear that we were reaching our limits. The LHC was obviously only going to increase its luminosity during 2011 and we had to work out a stable solution," says Richard.

The technical solution is called "luminosity levelling" (see box). Thanks to this technique, the LHCb experiment constantly runs at its maximum power without any adverse impact on safety and reliability. "The current system we use to keep our luminosity stable is automatic. It adjusts itself according to the natural changes that occur in the LHC luminosity over one fill," he confirms.

Constant running at maximum speed remains a big challenge for the offline processing and data analysts, who have to reconstruct the whole event (nature of particles, their energy, their trajectory, etc). However, thanks to the new strategy and the huge amount of additional data it has brought in, the experiment is on its way to delivering very important physics results. "There are very interesting, but extremely rare decays of the B particle involving muons that are benefiting a lot from the current high-luminosity strategy," says Pierluigi Campana, LHCb Spokesperson. "If everything goes as expected, by the end of this year we will have collected about 1 inverse femtobarn of luminosity, which should enable us to present our results with an unprecedented precision."

The results that the LHCb collaboration has started to release have to do with the rate and other specific parameters relating to the decay of the B_s (a particle made by a bottom antiquark and a strange quark) and B_d (a bottom antiquark plus a down quark) particles. Some of these parameters have already been studied at Fermilab's CDF and in other B-factories, and the current values show possible deviations from the Standard Model that make them worth studying in detail and trying to achieve a better precision. "One of the things we are looking into is the rate of the decay of the B_s into two muons. The decay is so rare that we can only expect to observe a handful of them per one billion B_s decays," explains Pierluigi Campana. "From the theory we know the value we can expect within the Standard Model. Recently, CDF announced possible evidence for a higher value of this rate, but data presented at the EPS Conference in Grenoble by LHCb (and by CMS, although with less precision) make this possibility quite unlikely. For the moment we have to stick to the Standard Model."

Later in the summer, the LHCb Collaboration also plans to finalise the data analysis of the decay of the B_s into the ψ and ϕ particles, which is potentially very sensitive to new physics. "The Grenoble Conference was another triumph of the Standard Model," concluded Pierluigi Campana, "as new phenomena had not (yet) been discovered. But we know precision physics has only just started at the LHC, and most probably the devil (i.e. new physics) will be in the details."

CERN Bulletin

Did you know?

Luminosity levelling: how does it work?

In order to make the luminosity stable over the whole duration of a particle fill in the LHC, beams are artificially separated vertically (by about 80 microns) when they approach the LHCb collision point. From the data observed so far, such a separation does not produce any bad beam-beam effects that could reduce the beam quality or luminosity lifetime.

Luminosity levelling automatically maximizes the target luminosity by looking at all the main parameters of the whole LHCb experiment: the read-out performance, the collision rate, the bandwidth, the event size, the average number of interactions per crossing, and the luminosity limit which is felt to be the safe limit for the detector as compared to the luminosity delivered by the LHC. The luminosity limit is what is successively being increased this year as more is learned about the detector performance.

A word from the DG

(Continued from page 1)

Schools out – but not at CERN

people who come, many of whom form lifelong friendships, and all of whom leave with an important addition to their CVs. But the programme is equally important for CERN, helping us to fulfil our mission and developing a growing community of ambassadors for science.

The summer student programme is part of CERN's broad educational portfolio that ranges from informal education for young children all the way to professional schools in physics, accelerator science and IT. On the way, it takes in the High School Teachers' programme. Much expanded over recent years to cater to the needs of teachers from our member states individually, the HST still includes a large multinational summer school.

This year, that school has given rise to a very exciting grass roots initiative from its African participants. As a result of their experience here, they've set up a network of science education promoters in Africa, with a mission to support science teachers on the continent, and to pass the message to all areas of African society that science is necessary for society to progress. Eleven teachers representing seven African countries are founding this network. I wish them every success.

But shouldn't summer be a time of relaxation? From what I hear, our summer students and high school teachers do all manage to fit a little relaxation into their busy time at CERN.

Rolf Heuer

LHC Report: Small is good

The LHC is enjoying a confluence of twos. This morning (Friday 5 August) we passed 2 inverse femtobarns delivered in 2011; the peak luminosity is now just over 2 x10^{33} cm^{-2} s^{-1}; and recently fill 2000 was in for nearly 22 hours and delivered around 90 inverse picobarns, almost twice 2010's total.

In order to increase the luminosity we can increase of number of bunches, increase the number of particles per bunch, or decrease the transverse beam size at the interaction point. The beam size can be tackled in two ways: either reduce the size of the injected bunches or squeeze harder with the quadrupole magnets situated on either side of the experiments. Having increased the number of bunches to 1380, the maximum possible with a 50 ns bunch spacing, a one day meeting in Crozet decided to explore the other possibilities.

The size of the beams coming from the injectors has been reduced to the minimum possible. This has brought an increase in the peak luminosity of about 50% and the 2 x 10^{33} cm^{-2} s^{-1} level has now been passed. The next stage is to adiabatically increase the bunch intensity with the all out maximum being around 1.6 x 10^{11} protons per bunch. The mechanics of squeezing further are reasonably complicated and this possibility has been shelved until after the next technical stop.

The higher peak luminosity has given some impressive production rates and we are seeing over 6 inverse picobarn an hour at the start of a fill. However, recently operational efficiency has been hit and fills have been lost. These difficulties have been caused by electrical network glitches, the effects of radiation on electronics, vacuum spikes, and UFOs, among other things. Some of these are clearly related to high intensity and high luminosity; it might be said that we are victims of our own success. Nevertheless on 2 August the LHC managed 90 inverse picobarns in one day.

Mike Lamont for the LHC team

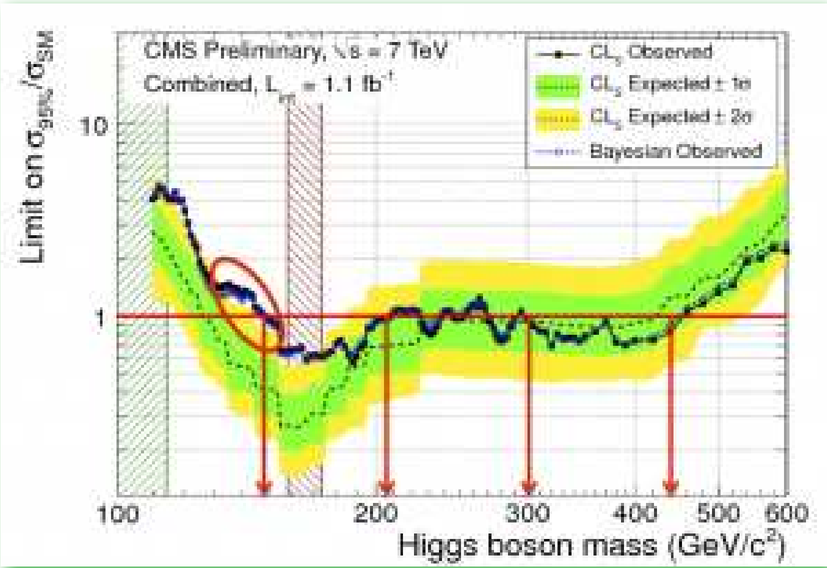
Small ripple shakes a roomful of physicists

After the exciting results announced by CERN physicists at the EPS conference, the CERN Quantum Diaries blog gave an insightful recap of the news. Here's what blogger Pauline Gagnon reported.

This Friday afternoon, the 750 physicists attending the European Physics Society meeting in Grenoble, France, were pleasantly surprised. The audience was waiting with some anticipation to see the first important set of results from the two large LHC experiments, ATLAS and CMS on the search for the Higgs boson. In fact, for the past two days, results had been shown from both experiments as well as from the Tevatron experiments in various individual channels. But today, the latest combined results from each experiment were shown in public for the first time. Of course, all physicists belonging either to the CMS or ATLAS experiment had had a chance to see their own results in advance, since they had been widely distributed and discussed. A small excess was seen in ATLAS, but nothing particularly convincing. In physicist's jargon, we refer to these as mildly significant excesses. This was found in one of the Higgs decay channels, namely when the Higgs boson decays into two W bosons.

But unbeknown to the ATLAS people, the CMS collaboration was also observing a similar excess that would correspond to a Higgs with the same mass and is seen in the same channel. So taken alone, none of these small ripples were compelling but once they show up in two completely different detectors, it starts being intriguing. Both experiments also reported small excesses for a Higgs to two Z bosons when the Z themselves decay into an electron or muon pair. What might turn out to be the first hint of a much sought after particle also occurred in a mass range not excluded by the Tevatron experiments.

It might not seem like much but this could be the first interesting bite we have in some decades. We are all researchers. This could turn us into "finders", something very few of us had a chance to live in their career. Hence the lively discussions that followed this session during the coffee break.



The CMS collaboration combined results for the Higgs boson search covering a possible Higgs in the region from 110 to 600 GeV.

But at the same time, we all know it is way too early to get excited. We need more data to be able to say something conclusive, something we do not risk regretting a few months down the line. Today, both experiments showed what they had after analyzing one inverse femtobarn of data (counted in the unit we use to see how much data we have). We already have another 0.4 inverse femtobarn ready to be analyzed. As soon as we can look at them in the coming weeks, we will see if the trend is maintained. The other important missing ingredient at this point is a full fledge combination of both results, taking into account all the common uncertainties. For example, we both use the same simulations to describe our backgrounds. Even though we crosscheck these simulations with real data, there is always a chance a small inaccuracy would trick us both in the same way. The combination team is getting to work on this combination tonight but it will take up weeks to complete this task.

Everybody agrees: We need more data and the combined results. But it is already interesting enough to keep staring in that direction. We might be seeing the caravan appearing in the far horizon. In just a few months, we will see it clearly or discover we all had sand in our eyes…

Another major conference is planned in late August in Mumbai, India. For sure, this combination and hopefully, more new analyzed data will be shown there.

But why do we care? Very simple. As much as we like to say we know about the particles that make up all matter we see around us, to this day, we, physicists, have no clue how the particles that make up all matter get their mass. Roughly speaking, that means we have no idea why any basic constituents of matter has a mass, (or weight), when we all know every object we grab has a mass! That Higgs boson, if it exists, would explain it all.

Friday 22 July
Pauline Gagnon for CERN's Quantum Diaries Blog

Matter-antimatter: balancing the scales

Using its innovative experimental set-up, the Japanese-European ASACUSA collaboration recently succeeded in measuring the mass of the antiproton with an unprecedented accuracy. This has been made possible by applying extremely high-precision laser techniques.

The antiproton is not something you could weigh by putting it on a pair of scales. Besides, it is not its "weight" (i.e. the Earth's gravitational force on it) that scientists aim to measure but rather its "mass". In addition, the yardstick against which the antiproton mass was measured is not the familiar kilogram, but the electron's mass. Technically speaking, this is no easy task, especially when an unprecedented precision is requested.

In the ASACUSA experiment, two counter-propagating ultra-sharp laser beams simultaneously hit an antiprotonic helium atom, where an antiproton orbits around the nucleus in place of one of its two electrons. The researchers tuned the laser frequencies to values at which the antiproton jumped between two of its energy levels. By precisely measuring these two energies, ASACUSA researchers were able to calculate the ratio between the mass of the antiproton and that of the electron. "It's the first time that the double-laser technique has been applied to antiprotonic atoms. Its importance resides in the fact that the first photon excites the antiproton to an intermediate virtual energy state (i.e. one that is not allowed by quantum mechanics) while the second photon completes the transition to the closest real energy state. Taking advantage of this principle, relatively low-power lasers can be used to achieve a very high precision in the proton mass measurement," explains Masaki Hori, an ASACUSA physicist who also conceived the two-laser set-up.

The antiproton turns out to have the same mass as the proton (of course, with respect to the electron mass), at least to the precision achieved by ASACUSA. The margin of error of the ASACUSA result is only 1.3 parts per billion, about the same as that for the proton-electron mass ratio. Since the Collaboration hopes to do even better in the future, we may soon 'know' the antiproton better than we know the proton. In this case, one of the world's fundamental constants may have to be redefined by measurement from the (so-far unobserved) anti-world.

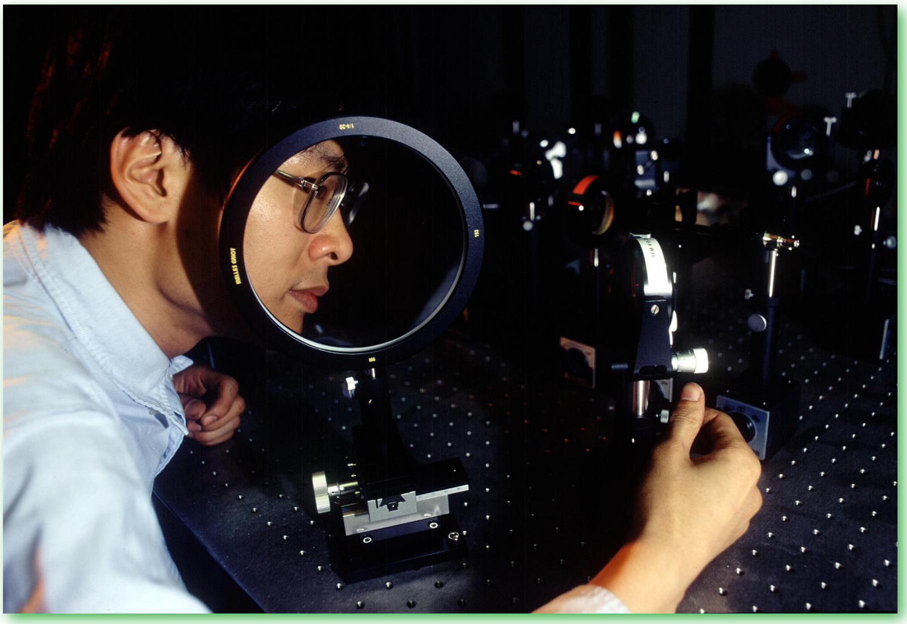
To perform its measurements, the ASACUSA experiment uses antiprotons from the Antiproton Decelerator, CERN's antimatter factory, which slows down antiprotons to a speed at which they can be brought to rest in the experiment's helium target and spontaneously replace electrons in the helium atoms. Such antiprotonic atoms can survive for microseconds in the target, plenty of time for laser spectroscopic studies to be made. "ASACUSA lasers are unique pieces in that they are extremely phase-coherent and highly reliable," explains Masaki Hori. "We were able to develop the two lasers thanks to collaboration with the Munich group led by Theodor Hänsch, who was awarded the 2005 Nobel Prize in Physics for inventing the optical frequency comb, which is a device used to measure the frequencies of light very accurately. A copy of this instrument is now installed at CERN and allowed us to achieve the high precision on the antiproton mass."

ASACUSA's recent result comes after a long period of testing of the experiment's performance and marks the beginning of a wide-ranging list of physics studies that the Collaboration is planning for the coming years. Together with the other AD experiments, ASACUSA will certainly help to shed light on antimatter properties.

See the video at:

http://cdsweb.cern.ch/record/1371767

CERN Bulletin



ASACUSA physicist, Masaki Hori, adjusts the optical system of laser beams.

CERN openlab promotes high-tech internships in a multicultural setting

Every year, hundreds of summer students bring a breath of fresh air to CERN, filling the restaurants and auditoriums with new energy. Among them, you'll find 15 students from 13 countries whose main interests lie in computing: the CERN openlab summer students.

CERN openlab is a unique collaboration between CERN and industrial partners (HP, Intel, Oracle and Siemens) carrying out large-scale research and development in the field of information technologies. Since 2003, CERN openlab has hosted 147 students in their own summer student programme. "Through our collaboration with industry, we are given access to cutting-edge technology well before it goes on the market," says Sverre Jarp, Chief Technology Officer for CERN openlab and coordinator of the student programme. "The openlab summer students spend two months working with this hardware and software, while also getting hands-on experience with the advanced IT solutions used in high energy physics."

The openlab student programme takes in undergraduate and postgraduate students in computer science and physics for a summer at CERN. The programme includes a series of lectures given by IT experts on advanced CERN computing topics, ranging from Grid middleware to software security. "Our lecture series is open to all summer students, however they are specifically aimed at IT-oriented students," says Sverre.

Along with these lectures, the openlab student programme gives students the opportunity to work on specialised computing projects with real applications. This year, student Grace Young from the Massachusetts Institute of Technology is working on adding functionality to the data analysis programs used by CERN physicists. "I am developing new classes on top of the ROOT software," she says. "Although I will only be here for two months, we will be able to offer the software to LHC physicists online before I leave."

At the end of their stay, many openlab students apply for follow-up positions in the IT Department. "Over the 9 years the programme has been running, over 30 students have returned as technical students or fellows," says Mélissa Gaillard, CERN openlab communications officer. "We hope to see some of the class of 2011 back at their desks over the next few years!"

Katarina Anthony

CERN openlab students, summer 2011.

Summertime and the studying is easy

The 2011 edition of one of CERN's most successful educational projects received over 1700 applications for the 255 places available. The participants came from 66 different countries across every continents.

Students followed the series of lectures and the official programme of visits and workshops. In addition, they did not neglect the social aspect of their experience at CERN and organised a variety of extra initiatives. These included the election of Mister Higgs and Miss Susy, the setting up of a Summer Student Football Team to play in the annual CERN championship, and the organisation of ballroom dancing lessons. For the first time this year, the programme also attracted the attention of the media: TV networks, journalists and authors came to CERN to meet the students and to get their impressions. Students also produced a video – "We think physicists CAN dance" – that will be sent to the American show "So you think you can dance". We look forward to reporting on their future successes in all fields!

CERN Bulletin

This year's Summer Students pictured in the garden in front of the Globe of Science and Innovation at CERN.

CERN opens up its control rooms to youngsters

CERN is inviting 13 to 18 year-olds to come and spend a couple of hours in the control rooms of the LHC and its experiments. Registration is now open.

Is your neighbour's kid eager to come and see what's going on in the CERN control rooms for himself? Is your niece from Germany fascinated by the famous accelerator near Geneva that she's heard about and asking to know more? Then Researchers Night is for them! From 6.00 p.m. on Friday 23 September until 1.00 a.m. the following morning, the LHC and its experiments will open their doors to 13 to 18 year-olds. They are invited to come and spend a couple of hours in the control rooms watching the physicists and taking part in various activities. ALICE, ATLAS, CMS, LHCb, TOTEM, and the CERN Control Centre (CCC) will all be welcoming visitors. For this second year of CERN's involvement in European Researchers Night, the CERN exhibitions will be open late and special activities will be organised in Microcosm. In particular, Marie Curie Fellows will be running a science café, during which the youngsters and their adults accompanying them will have the opportunity to ask all the questions they want.

Sign up on the CERN Researchers Night website:

http://nuitdeschercheurs.web.cern.ch/

The number of places is limited, so applicants will be selected based on the reasons they give for wanting to take part, their age and their languages, as well as the availability of places at the requested times.

CERN Bulletin

Computer Security
Sécurité informatique

iPhones, androids & history repeating

Remember when everyone was bashing Bill Gates because his operating system was insecure and a primary target for malicious software? While Microsoft has (tried to) improved on this, the IT world keeps on turning and the new target is your mobile phone. The Android and iPhone market is still growing. Can you live without your mobile phone today? Probably not. Mobile phones have become part of our identity.

They are with us all the time and record every step we take (see http://www.cnn.com/TECH/computing/9911/29/eu.p3.ban.idg/index.html). Do you worry that your iPhone sends a unique token to every app company who wants to pinpoint you and your activity? 15 years ago there was a rebellion and legal measures against Intel's Pentium II/III unique serial number intended to do the same (see http://www.cnn.com/TECH/computing/9911/29/eu.p3.ban.idg/index.html). Also, think about how much confidential or sensitive stuff you already store on your phone (e.g. your mail, music, photos, credentials). In the future, you might even be able to pay with your phone - initial plans have already surfaced from all major Internet companies. This will make your mobile phone an even more valuable target for attackers - cyber attackers or just old-fashioned thieves!

We don't want to "cry wolf" here, but you should be aware that the shiny world of iPhones and Androids has a dark side, too. Thus, beware! Some apps available from your favourite app store are malicious and try to steal your private data once installed (http://www.zdnet.com/blog/security/bogus-android-apps-lead-to-malware/8212) or auto-dial expensive phone numbers. Unfortunately, the open model for Android apps employs neither quality control nor an approval process. Several Android apps, e.g. wallpaper apps or sound clips, have already been identified as being malicious. For the iPhone, things look a bit better since Apple tightly controls their app store. But the risk remains high for those who have "unlocked" their iPhone.

Finally, if you want to roam around incognito, switch off the geo-localization services on your mobile phone, and recall that a unique token might still identify you to your app company. Use common sense before installing a new app or sound clip. Check what permissions the application asks for. If you just want, for example, a compass and it asks for your address book and Internet connection, don't install the app. If in doubt, don't install. In order to protect your mobile phone against theft, lock it with a PIN code, back it up regularly, and familiarize yourself with ways to wipe your mobile phone remotely if it gets lost or stolen (1).

Of course, if you have questions, suggestions or comments, please contact Computer.Security@cern.ch or visit us at http://cern.ch/security.

(1) *The CERN Mail Service provides a possibility to remotely wipe your phone's Inbox: Log into CERN webmail (http://cern.ch/owa), select "Options" and "See All Options" and click then on "phone". The "Wipe Device" option can then be used to clear all Exchange information.*

Computer Security Team

Library
Bibliothèque

News from the Library

2010
A record year for CERN publications

Last year, CERN authors published more articles than any previous year.

546 journal articles written or co-authored by CERN authors and published in 2010 can be found at the CERN Document server. This is about 25% more than the previous year. Contributions to conference proceedings have increased by over 50%! There are currently 867 but this number is still rising as more conference proceedings are submitted.

The actual numbers for journal articles, conference contributions, and theses completed in 2010 under partial CERN supervision are available on the Annual Report page. This page also shows the distribution of articles by journal (the Journal of High Energy Physics coming out on top, with 88 articles), publisher, and research area.

See the CERN annual report at:

http://library.web.cern.ch/library/content/ar/cernrep/varia/annual_reports/2010_publications.html

Please send questions and comment to library.desk@cern.ch.

CERN Library

Official news

Members of the personnel shall be deemed to have taken note of the news under this heading. Reproduction of all or part of this information by persons or institutions external to the Organization requires the prior approval of the CERN Management.

ANNUAL GENERAL MEETING OF THE PENSION FUND

All members and beneficiaries of the Pension Fund are invited to attend the

Annual General Meeting

to be held in the CERN Council Chamber

on Tuesday 20 September 2011

from 10:00 a.m. to 12:00 p.m.

Coffee and croissants will be served prior to the meeting as of 9:30 a.m.

CERN Pension Fund

Take note

ELECTRONIC INDIVIDUAL BREAKDOWN OF PENSION RIGHTS AND/OR TRANSFER VALUE

Commencing this year, members of the personnel will be notified by e-mail of their annual breakdown of pension rights and/or transfer value. Each person receiving the e-mail notification will be invited to consult this breakdown by clicking on a link protected by AISlogin and a password.

Benefits Service of the Pension Fund
pension-benefits@cern.ch

TRIAL ACCESS TO CAMBRIDGE UNIVERSITY PRESS EBOOKS

From 1 August till 31 October, CERN users are invited to enjoy a trial access to all Cambridge University Press electronic books:

http://ebooks.cambridge.org/

Please don't hesitate to send feedback to library.desk@cern.ch.

CERN Library

Language training

SUMMER ORAL EXPRESSION ENGLISH COURSE

An English Oral Expression course will take place between 15 August and 30 September 2011.

Schedule: to be determined (2 sessions of 2 hours per week).

Please note that this course is for learners who have a good knowledge of English (CERN level 7 upwards).

If you are interested in following this course, please enrol through the following link

https://cta.cern.ch/cta2/f?p=110:9:1576796470009589::::X_STATUS,XS_COURSE_NAME,XS_PROGRAMME,XS_SUBCATEGORY,X_COURSE_ID,XS_LANGUAGE,XS_SESSION:D,,1,,4368,B,

Or contact:

Kerstin FUHRMEISTER (70896)

Tessa OSBORNE (72957)

Seminars

MONDAY 8 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
Main Auditorium, Bldg. 500

09:15 - Cosmology (Theoretical Particle Physics) (1/5)
L. VERDE / ICREA AND ISC, UNIV. OF BARCELONA, SPAIN

10:15 - Cosmology (Theoretical Particle Physics) (2/5)
L. VERDE / ICREA AND ISC, UNIV. OF BARCELONA, SPAIN

11:15 - Physics and CP Violation (Experimental Physics) (4/4)
G. RAVEN / NIKHEF, AMSTERDAM

12:00 - Discussion Session
L. VERDE, G. RAVEN

TUESDAY 9 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
Main Auditorium, Bldg. 500

09:15 - Cosmology (Theoretical Particle Physics) (3/5)
L. VERDE / ICREA AND ISC, UNIV. OF BARCELONA, SPAIN

10:15 - Astroparticle Physics (1/3)
P. BINETRUY / APC U. PARIS 7 DENIS DIDEROT

11:15 - Future Colliders and Physics
F. RICHARD / LAL-ORSAY, FRANCE

12:00 - Discussion Session
L. VERDE, P. BINETRUY, F. RICHARD

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

AdS/CFT and the cosmological constant problem
K. PAPADODIMAS

WEDNESDAY 10 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
Main Auditorium, Bldg. 500

09:15 - Cosmology (Theoretical Particle Physics) (4/5)
L. VERDE / ICREA AND ISC, UNIV. OF BARCELONA, SPAIN

10:15 - Astroparticle Physics (2/3)
P. BINETRUY / APC U. PARIS 7 DENIS DIDEROT

11:15 - Future Collider Technologies (Experimental Physics) (1/2)
D. SCHULTE / CERN

WEDNESDAY 10 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
Main Auditorium, Bldg. 500

12:00 - Discussion Session
L. VERDE, P. BINETRUY, D. SCHULTE

17:00 - Poster Session

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

Event-generator physics for the LHC
M. SEYMOUR / SCHOOL OF PHYSICS AND ASTRONOMY SCHUSTER LABORATORY-UNIVERSITY

THURSDAY 11 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
Main Auditorium, Bldg. 500

09:15 - Cosmology (Theoretical Particle Physics) (5/5)
L. VERDE / ICREA AND ISC, UNIV. OF BARCELONA, SPAIN

10:15 - Astroparticle Physics (3/3)
P. BINETRUY / APC U. PARIS 7 DENIS DIDEROT

11:15 - Future Collider Technologies (Experimental Physics) (2/2)
D. SCHULTE / CERN

12:00 - Discussion Session
L. VERDE, P. BINETRUY, D. SCHULTE

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

Search for Resonances in the Dilepton Mass Distribution in pp Collisions at sqrt(s) = 7 TeV
S. J. HARPER / RUTHERFORD APPLETON LABORATORY-STFC, W. FEDORKO / MICHIGAN STATE UNIVERSITY

FRIDAY 12 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
Main Auditorium, Bldg. 500

10:15 - Closing Lecture
H. MURAYAMA / IPMU,TOKYO/LBNL

TUESDAY 16 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
Main Auditorium, Bldg. 500

Student Session

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

TBA
M. SPRADLIN / BROWN UNIVERSITY

WEDNESDAY 17 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
Main Auditorium, Bldg. 500

Student Session

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

Freeze-In of Dark Matter and Long-Lived States at the LHC
L. HALL / UNIVERSITY OF CALIFORNIA BERKELEY

THURSDAY 18 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
Main Auditorium, Bldg. 500

Student Session