CERN Bulletin

Nos 31, 32 & 33 – 4, 11 & 18 August 2010

Physics buzz in Paris

The International Conference on High Energy Physics (ICHEP) took place from 22 to 28 July in Paris, and first results from the Large Hadron Collider experiments received top billing.

More than 1,100 physicists gathered in the *Palais des Congrès* conference centre to attend ICHEP, the world's premier particle physics conference, where scientists presented and discussed the latest and most intriguing results from experiments in particle physics, particle astrophysics and cosmology, innovative theoretical approaches and predictions, and concepts for future accelerators and particle detectors.

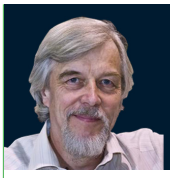
The buzz about the LHC experiments caught the eye of French President Nicolas Sarkozy, who addressed the conference on Monday 26 July. President Sarkozy exhorted the particle physics community to continue its quest to understand the nature of the Universe, and stated his belief that investment in fundamental research is critical for the progress of mankind. Steve Myers started off the morning with a presentation on the LHC accelerator. He was followed by the spokespersons for ALICE, ATLAS, CMS and LHCb, who summarized the most important results from the performance of their detectors with the first few months of collision data, and the first measurements of proton collisions at 7 TeV.

One of the items of breaking news from the ATLAS and CMS experiments was the first observation of top quark candidates at the LHC. The top, the heaviest elementary particle observed to date, has so far only been produced at Fermilab's Tevatron collider in the US. ATLAS and CMS also presented their measurements of the W and Z boson cross-sections, or probabilities of being produced. These measurements - made at energies 3.5 times higher than ever before - confirm predictions from the Standard Model. The two experiments have also measured the expected difference between the production of positively and negatively charged W bosons, which may ultimately help physicists better understand the structure of the proton.

The ALICE experiment's new measurement of the number of charged particles produced from proton collisions at 7 TeV does not agree with predictions from theoretical models, and will send physicists back to their computers to further refine the models so that they better reflect the way the Universe works and better predict new phenomena.

LHCb reported clear measurements of several rare decays of beauty mesons, particles which contain a beauty quark. With the collision data expected to be delivered by

(Continued on page 2)



A word from the DG

Postcards from Paris

Earlier this week I was in Paris to join particle physicists from around the world at the International Conference on High-Energy Physics, ICHEP 2010. This conference series began in 1950 as the 'Rochester series', named for the original venue in the US, and its meetings rapidly became the place to present the latest results and discoveries. Particle physics has certainly come a long way since those early days. In 60 years, the meetings have witnessed the birth and growth of CERN, the development of the current Standard

(Continued on page 2)

In this issue

News

Published by:
The European Organization for Nuclear Research - CERN
1211 Geneva 23, Switzerland - Tel. + 41 22 767 35 86
Printed by: *CERN Printshop*

A word from the DG

(Continued from page 1)

Postcards from Paris

Model of particles and their interactions - and now the first results from a truly international project, the LHC.

I'd had the opportunity to be present at some of the previous meetings where important discoveries were announced, but this was the first time I had the privilege to attend as the Director-General of the laboratory that was the focus of much of the attention. It is clear from many of the people with whom I talked that the high quality of the data from the detectors, and the speed with which they have been analysed thanks to the performance of the Grid, are both greatly appreciated. In particular, the experiments were able to present results from data collected up to only a few days before the conference.

This excellent outcome for the LHC has provided a long-awaited boost to the particle physics community. Now we can look forward to continued improvement in the performance of the collider, with increased luminosity providing higher data rates. A forthcoming objective is to operate with "bunch trains", in which more bunches than at present are grouped closely together. This will be yet another step on the path towards the further increase in luminosity by a factor of about 60, which we plan to achieve by the end of 2010 – and it will put the experiments in a strong position for presenting some exciting physics at the next conference in the ICHEP series, in 2012.

Rolf Heuer

Physics buzz in Paris

(Continued from page 1)

the LHC over the next few months, the collaboration expects to make precise studies of the nature of CP violation, the difference in the way Nature treats matter and antimatter. These studies will allow LHCb to confirm or refute unexpected results regarding this matter-antimatter difference recently announced by the experiments at the Tevatron.

And even with a small amount of data, ATLAS and CMS have already presented limits for the possible existence of several exotic particles. ATLAS has placed new, improved limits on the possible existence of excited quarks, excluding their existence with masses of less than 1.29 TeV. The existence of such heavy quarks would imply that quarks are not fundamental, but are made up of even smaller particles. By collecting data from its detector in the period between collisions of LHC beam bunches, CMS has narrowed the limits on the existence of a proposed particle called a stopped gluino, showing that it cannot exist with lifetimes of longer than 75 nanoseconds.

All the experiments noted that the Worldwide LHC Computing Grid, which has met or even exceeded expectations in the first few months of collision data-taking, was greatly aiding their ability to produce first results quickly.

In his presentation, Myers reviewed events at the LHC accelerator since 2008, with special emphasis on the progress since the first collisions in November 2009. He also briefly presented the 10-year plan recently agreed by the CERN Management and LHC leadership. In addition to the known schedule for the next few years—the current LHC run will end in December 2011, and will be followed by a 15-month shutdown--there is also provision for two three-year running periods followed by long shutdowns in 2016 and 2020.

Another hotly anticipated presentation at ICHEP came from the CDF and DZero experiments at the Tevatron. The two experiments have not yet spotted the Higgs boson, but have further limited the territory in which it may be hiding. So the Higgs is still out there, waiting to be found, and the LHC experiments have shown at ICHEP that they are well on the way to joining the hunt.

Katie Yurkewicz

Links for further information:

The CERN press release:

http://press.web.cern.ch/press/PressReleases/Releases2010/PR15.10E.html

President Sarkozy's speech:

http://www.elysee.fr/president/les-actualites/discours/2010/35eme-conference-internationale-de-la-physique-des.9370.html

Symmetry Breaking article on new results from the LHC:

http://www.symmetrymagazine.org/breaking/2010/07/26/lhc-results-not-just-the-same-old-thing/

Fermilab's Higgs press release:

http://www.fnal.gov/pub/presspass/press_releases/Higgs-mass-constraints-20100726.html

CERN, one of the proudest flagships of European cooperation

French diplomat François de Rose was one of CERN's founding fathers. Shortly after the end of World War II, on a diplomatic posting in the United States, he made the acquaintance of several leading physicists who, like him, were sitting on the Atomic Energy Commission, a body set up by the fledgling United Nations. He became friends with Robert Oppenheimer and met Isidor Rabi and the Frenchmen Lew Kowarski, Pierre Auger and Francis Perrin, all physicists driven by the conviction that developing fundamental research infrastructure was one of the keys to rebuilding Europe.

The United States had built itself powerful particle accelerators and the Soviet Union would soon follow suit. The growing sophistication and scale of such apparatus were beyond the means of a single European state, and this is what spurred François de Rose and his scientist friends to embark upon a tour of Europe's capitals, advocating to governments the creation of the first fundamental research centre on a truly European scale. And the rest is history… CERN was founded in 1954 and François de Rose was Council President from 1958 to 1960. His term of office notably saw the extension of the CERN site into French territory. He was also French delegate to the Council for a number of years. Nearly 60 years on, CERN has become the world's leading fundamental physics laboratory, a source of immense satisfaction to François de Rose, the only founding father still alive. Now in his hundredth year, he has agreed to share his impressions of the Organization with the readers of the Bulletin.

You were part of the great adventure that was the creation of CERN. In the early 50s, fundamental physics was dominated by the USA and the USSR, while European science was in decline. Today CERN is the world's largest particle physics laboratory. What are your thoughts on this development?

François de Rose, during CERN's official 50th Anniversary Celebrations in 2004.

I can still recall the pride and enthusiasm we felt during those early pioneering days. We all felt a bit like adventurers on an extraordinary journey. This feeling was common to everyone involved in the project, from the giants of science like Niels Bohr to the humblest theorist or experimenter. We had a tremendous *esprit de corps* right from the start.

I think it's the only time a scientific endeavour has ever inspired such commitment and passion. I even believe that CERN's influence goes far beyond its own field. CERN has become a byword for large international scientific undertakings, which explains why it reaches across frontiers and attracts scientists, students and professors from all countries of the world.

Do you still follow CERN news?

I take an interest in CERN research when it's not too hard to understand. I was proud and happy at the start-up of the LHC. I'm particularly interested in the aspects of the LHC that deal with the origins and evolution of the Universe. It's letting us look into a whole area that used to be completely closed off. The future discoveries will certainly not solve all the riddles we're facing but they might allow us to take a few tentative steps into this uncharted territory.

Why do you have such a strong attachment to CERN?

I'm attached to CERN because it's an amazing undertaking that brought me into contact with some extremely intelligent people, opened my eyes and exposed me to concepts beyond my imagination. It's also because CERN is one of the proudest flagships of European cooperation, a hub for European culture in the most universal of its incarnations, and a centre for peace where researchers from all over the world can meet. As a former diplomat, I'm proud of the success of this international cooperation venture.

And as a diplomat, what is your opinion on the links between fundamental science and cooperation between nations?

You could say that everything related to the sharing of knowledge contributes to bringing peoples closer. So often the tool of war-makers in the past, science has become an instrument for bringing nations together. Archimedes, Leonardo da Vinci and many others contributed to engines of war. But it is said that fireworks were the only use the Chinese could find for gunpowder. Having rubbed shoulders with scientists all my life, I can unequivocally state that they are devoted to the peaceful development of their activities.

In your view, what use does fundamental science have in a world interested mainly in short-term financial gain?

Its greatest use is to provide intellectual speculation of the most disinterested kind. The whole principle of fundamental science runs against the notion of usefulness. Even so, many of fundamental research's spin-offs have nothing to do with the original aims but are simply direct or indirect consequences. A good example of this is the Worldwide Web, which originated at CERN.

What message would you like to send to CERN and the scientists working there?

Several generations of scientists and administrators have passed through CERN's doors over the past fifty years or more. They have all been imbued with an awareness of the scientific importance and international dimension of their common endeavour. My wish would be for everyone who has the privilege of working at CERN to be permanently inspired by those same ideals. Actually, I'm certain this will be the case.

Corinne Pralavorio

Preparing for faster filling

Following the programmed technical stop of last week, operators focussed on preparing the machine for faster filling, which includes multibunch injection and a faster pre-cycle phase.

The LHC operational schedule incorporates a technical stop for preventive maintenance roughly every six weeks of stable operation, during which several interventions on the various machines are carried out. Last week these included the replacement of a faulty magnet in the SPS pre-accelerator, which required the subsequent re-setting of the system of particle extraction and transfer to the LHC.

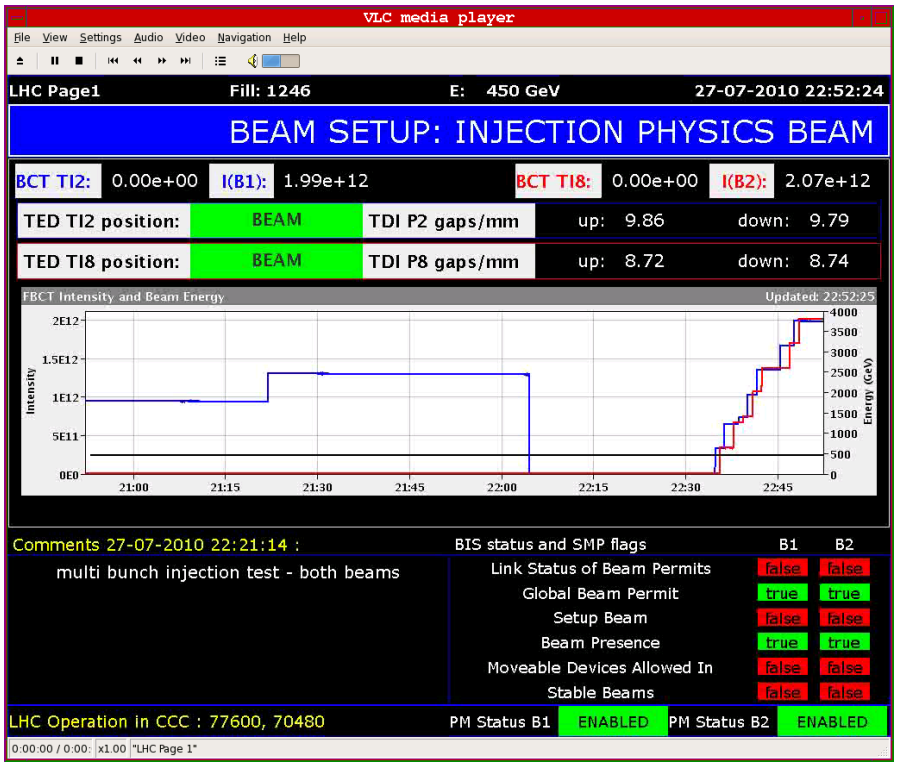
At the end of last week, all the machines were handed back for operation and work could start on accommodating all the changes made into the complex systems in order for normal operation to be resumed. These 'recovery' operations continued through the weekend and into this week.

At the beginning of this week, operators succeeded in producing four bunches and sending them to the LHC in the same SPS cycle, thus reducing the time needed to fill the accelerator. On Tuesday, using this scheme for the first time, 25 bunches were injected in each direction (50 in total in the machine). However, this scheme has yet to be brought up to the necessary conditions for physics.

An important change that experts have implemented during the last technical stops now allows the current in the magnets to be changed at the nominal rate of 10 Amps/s. The operations team has this week applied this faster rate to the pre-cycle phase of the LHC cycle, which will allow faster turnaround of the machine between physics fills. Before the technical stop the time needed for the pre-cycle was about one and a half hours. This same operation is now about 30 minutes quicker.

On the night of Thursday 29 July, the LHC was filled with 25 bunches per beam (16 colliding pairs per experiment). This should increase the integrated luminosity per day by a factor of 2.

CERN Bulletin



The LHC1 screen shot during the first multibunch injection operation.

The proton as seen by TOTEM

TOTEM, one of the smaller experiments at the LHC, has recently recorded the first candidates of proton-proton elastic scattering at a collision energy of 7 TeV. Studying the elastic scattering between two protons is a powerful way of exploring the inner structure of the proton, one of the most common, yet still poorly understood, particles we observe in Nature.

The elastic scattering between two colliding particles is a process in which the kinetic energy of the particles is the same before and after the interaction; only their direction of propagation is modified by the scattering. In more scientific terms, this means that particles transfer part of their momentum in the interaction but not their energy. By studying these kinds of processes, physicists can infer the inner structure of the interacting particles. One of the goals of the TOTEM experiment at the LHC is to use this technique to probe the proton.

"We are happy that we are seeing candidates for elastic and diffractive proton-proton scattering at the LHC for the first time" says Karsten Eggert, TOTEM Spokesperson. "Intensive studies of these phenomena started in the late 1970s at CERN's Intersecting Storage Rings (ISR) and continued at HERA and the Tevatron". TOTEM's physics programme looks at the elastic scattering of the two protons over a large range of momentum transfer. The higher the transferred momentum, the smaller the distance at which one proton probes the other.

To make these unique observations, TOTEM can count on the so-called Roman Pot detectors installed over a distance of 440 m on both sides of the CMS collision point (Point 5 of the accelerator ring). In the case of elastic scattering and many other diffractive events occurring when the protons collide in the LHC, particles need to be detected at tiny angles (less than 1 mrad) relative to the beam line. The Roman Pots have to be positioned close to the beam line. "The positioning of these devices is a very delicate manoeuvre", explains Mario Deile, TOTEM run co-ordinator. Working together with Ralph Assman's collimation team, we have recently succeeded in moving our detectors extremely close to the beam and have been able to locate it with very high precision. We performed this exercise at 450 GeV per beam and will later do it at 3.5 TeV. At the end of the exercise, all the twelve Pots were aligned with high precision with respect to the beam centre and everything went very smoothly. This proves that we have acquired detailed information on our apparatus and the machine itself." "We could see very clean tracks of particles scattering at very small angles and travelling along the beam line. This shows that all the detectors are working really well", confirms Karsten Eggert.

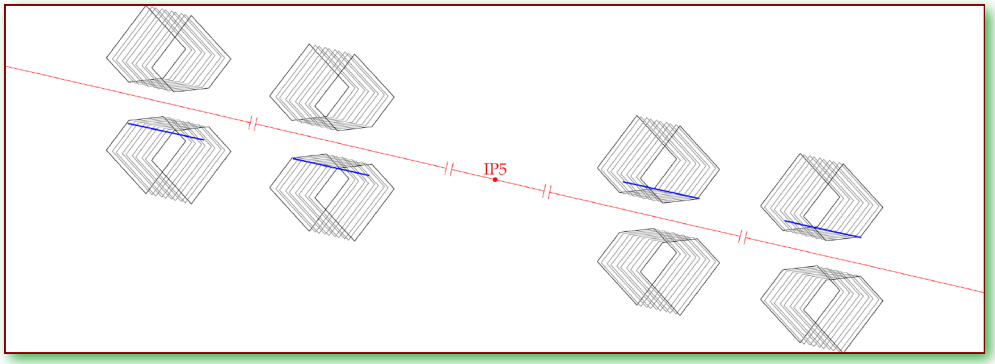
Although, at first sight, the proton might seem to be one of the best known particles, its inner structure is far from being completely understood by scientists. This is the gap TOTEM is set to fill.

More information about the TOTEM experiment can be found at:

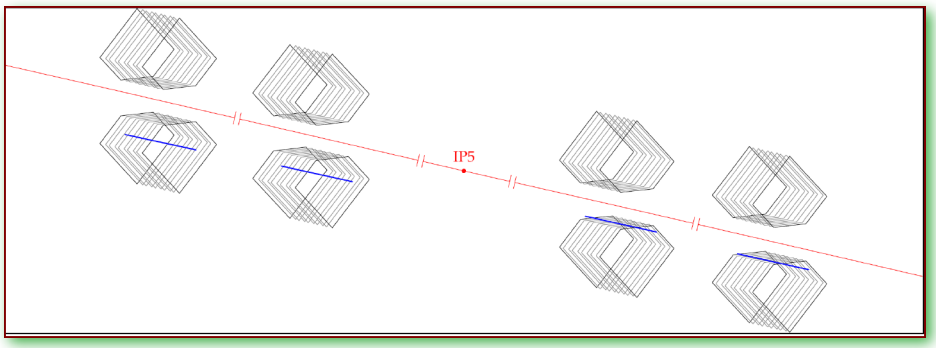
http://totem.web.cern.ch/Totem/

The TOTEM Collaboration will present its most recent results at the LHC Physics Day organised by the LPCC on 6 August.

CERN Bulletin



One of the first elastic event candidates recorded by the TOTEM experiment. The proton tracks are reconstructed in the Roman Pots detectors 220m away from the intersection point IP5 (not to scale).



The signals left on the TOTEM detector by a proton-proton interaction known as the "Double Pomeron Exchange". This is the first time that such an interaction has been observed at a collision energy of 7 TeV.

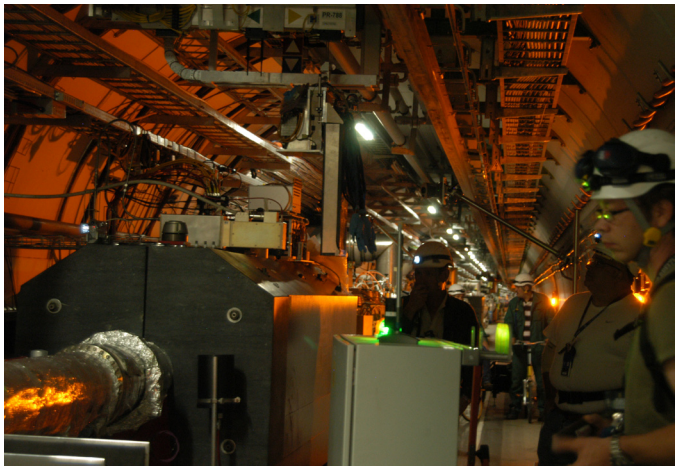
LHCf completes its first run

LHCf, one of the three smaller experiments at the LHC, has completed its first run. The detectors were removed last week and the analysis of data is continuing. The first results will be ready by the end of the year.

LHCf is made up of two independent detectors located in the tunnel 140 m either side of the ATLAS collision point. The experiment studies the secondary particles created during the head-on collisions in the LHC because they are similar to those created in a cosmic ray shower produced when a cosmic particle hits the Earth's atmosphere. The focus of the experiment is to compare the various shower models used to estimate the primary energy of ultra-high-energy cosmic rays. The energy of proton-proton collisions at the LHC will be equivalent to a cosmic ray of 1017eV hitting the atmosphere, very close to the highest energies observed in the sky. "We have now completed the first phase of our research programme", says Oscar Adriani, LHCf Deputy Spokesperson. "The experiment has been designed to work with high-energy particles but at a low luminosity. The LHC is now increasing the luminosity, which can cause problems for our detectors. At the same time, we have now collected enough data at 450 GeV and 3.5 TeV per beam".

The detectors that LHCf used for this first run were mainly plastic scintillators. The collaboration will now work on replacing them with more radiation-resistant crystal scintillators, to be ready by 2013 when the LHC will run at 7 TeV per beam. The collaboration also plans to change the position of its silicon detectors to improve the performance of the experiment in measuring the energy of the interacting particles. "It was an advantage for us to be able to collect data at lower energies as this will allow us to compare the theoretical models also at these intermediate energy regions. The UA7 experiment carried out at the SPS accelerator in the 1980s already provided information for 450 GeV energy collisions. LHCf will be the first to provide results at 3.5 TeV and beyond", confirms Adriani. The results of the data analysis at 450 GeV will be available by the end of the year, while data at 3.5 TeV will be analysed in 2011.

CERN Bulletin



One of the two LHCf detectors during the removal operations inside the LHC tunnel.

CERN Library *Bibliothèque*

News from the Library

A borderless Library

The CERN Library has a large collection of documents in online or printed format in all disciplines needed by physicists, engineers and technicians. However, users sometimes need to read documents not available at CERN. But don't worry! Thanks to its Interlibrary loan and document delivery service, the CERN Library can still help you. Just fill in the online form or e-mail us. We will then locate the document in other institutions and order it for you free of charge.

The CERN Library cooperates with the largest libraries in Europe, such as ETH (Eidgenössische Technische Hochschule) in Zurich, TIB (Technische Informationsbibliothek) in Hanover and the British Library in London.

Thanks to our network and our expertise in document search, most requests are stabilised in record time: articles are usually served in .pdf version a few hours after the order and books or other printed materials are delivered within a few days.

It is possible to ask for all types of documents such as reports, conference proceedings, theses, or even standards. In both the latter cases, if we cannot order the document in a library we will purchase it for you, but you will then be asked for a budget code.

External loan and document delivery online form:

http://library.web.cern.ch/library/Library/ill.html

Contact:

external.loans@cern.ch

CERN Library

ALPHA freezes antiprotons

Laboratories like CERN can routinely produce many different types of antiparticles. In 1995, the PS210 experiment formed the first antihydrogen atoms and a few years later, in 2002, ATRAP and ATHENA were already able to produce several thousand of them. However, no experiment in the world has succeeded in 'trapping' these anti-atoms in order to study them. This is the goal of the ALPHA experiment, which has recently managed to cool down the antiprotons to just a few Kelvin. This represents a major step towards trapping the anti-atom, thus opening a new avenue into the investigation of antimatter properties.

Just like the atom, the anti-atom is neutral. Unlike the atom, the anti-atom is made up of antiprotons (as opposed to protons in the atom) and positrons (as opposed to electrons). In order to thoroughly study the properties of the anti-atoms, scientists need to have them trapped for a reasonable amount of time (up to one second). The ALPHA experiment, installed at CERN's Antiproton Decelerator (AD), has recently reached an important milestone by cooling antiprotons to just a few Kelvin. "This is the first time that a cloud of antiprotons has been cooled to such low temperatures", explains Jeffrey Hangst, ALPHA's spokesperson. "The next step will be to mix the cool antiprotons with positrons and form cold anti-atoms that can stay trapped and can then be studied".

The technique used by the ALPHA collaboration to cool down the antiprotons is borrowed from the neutral atom physics field and is called 'evaporative cooling'. "You have to imagine your antiprotons contained in a bowl – in our case this is an electrostatic well. Initially, antiprotons move about quite a lot because they have quite a high energy. If you lower one side of the bowl, the hot ones will come out while the others will continue to interact. They end up with a lower temperature than they had before the hot ones escaped. You keep doing it: you let the hot ones escape while those remaining in the bowl come to a lower temperature thermal equilibrium", says Jeffrey. Although this process leads to a heavy loss of antiprotons in the sample, the overall probability of forming anti-atoms that can be trapped increases drastically.

The AD machine produces antiprotons at an energy of 5.3 MeV that corresponds to about $6x10^{10}$ Kelvin. Using the 'evaporative cooling' technique, the ALPHA collaboration managed to cool the antiprotons down to a temperature of 9 Kelvin, increasing the probability of trapping the anti-atoms by a factor of 100 with respect to other cooling techniques. "In order to achieve this temperature of just a few Kelvin, we need to carefully control the voltage in our trap with a precision of the order of a millivolt. Indeed, a potential change of 1 V is equivalent to a temperature change of more than 11000 K.! The electric noise in the system must be kept very low to avoid heating up the antiprotons. The whole cooling process takes tens of seconds to complete", explains Jeffrey.

The ALPHA collaboration is now working to integrate this technique into the main experiment. Trapping antihydrogen will be the next step, which will hopefully happen by the end of the year.

CERN Bulletin

Members of the ALPHA collaboration working on the apparatus in the Antiproton Decelerator experimental hall at CERN.

The importance of the Summer Student Programme

As every year, the summer months see the arrival at CERN of summer students. Over a seven-week period beginning on the first Tuesday in June, students arrive at CERN for stays that will last from 8 to 13 weeks. This means that some of them are already coming to the end of their stay.

For 2010, a total of almost 1 650 applications was received: 950 from students coming from Member States and 700 from other countries. Of these, 237 applications were accepted: 127 from the Member States,10 from the USA, 5 from Japan and 4 from Israel, and 91 from other countries. Each year, there are students from new countries, and this year CERN is welcoming students from the Philippines for the first time. "The number of applications has been growing steadily since the programme started in 1962," reports Sharon Hobson, coordinator of the Summer Student Programme in the Recruitment Service. "The vast majority are physics students, although the number of students in engineering and computer science programmes has grown."

The participants' schedule at CERN is determined by the daily rhythm of Globe lectures, which cover a variety of subjects. Students also have an opportunity to put what they have learned into practice in a science project assigned to them by their supervisor. "Students are free to attend the courses that they find interesting and useful for their project. The Globe lectures always draw a full house," notes Sharon Hobson. "The way the projects are assigned is like this: the supervisors come up with a number of projects and then a computer program selects the students and assigns each of them a project in a field relevant to their studies."

To be eligible for the Programme, students must have completed at least three years' university studies. In addition, the university teachers are asked to send a report that will be used to assess the student's profile. The programme for the following year is generally posted on the internet in September. Interested students can study the programme and apply. Applications have to be sent before the end of January. Selections are then made in March, and the applicants are informed in April.

The programme represents a valuable opportunity for students as a potential springboard to a professional career. It allows them to acquire experience while working in an attractive environment. As Sharon Hobson observes: "There is an excellent atmosphere among the Programme's participants and they develop a strong bond. Just to illustrate: last year's students purchased a sound system, which they installed in the Pump Hall, where the students hold their social events. There is now a plaque on the amplifier that reads, 'From Summies 2009 to all future Summer Students – Rock On!'"

Laëtitia Pedroso

For further information about the 2010 Summer Student Porgramme, visit the dedicated page :

http://hr-recruit.web.cern.ch/hr-recruit/summies/default.asp

The 2010 Summer Students gathered in front of the Globe for the souvenir picture.

19 years old and a neutrino expert

Courtney Williams pays a visit to the CERN Library.

Courtney Williams, a 19-year old British student, is passionate about physics. She has just spent a week at CERN, from 12 to 16 July, a prize she won for a project on neutrinos in the framework of the European Union Contest for Young Scientists (EUCYS) held in September 2009.

"I'm returning to London after a very busy week at CERN but I hope to be back again one day, this time to work here. CERN is an amazing place for any scientist and it's definitely the place to be if you want to study particles", said Courtney during our interview.

Courtney has just completed the first year of her physics degree course at Sheffield University, which means that, combined with her two years of A-level studies, she has now been studying physics - and neutrinos in particular - for a total of 3 years. Before starting her university course, Courtney spent the summer break working on ACoRNE, the Acoustic Cosmic Ray Neutrino Experiment which detects neutrinos by "listening" to the sound they produce when they come into contact with water.

Courtney's project on the experiment won her the CERN EIROforum prize at the 21st EUCYS competition, which was held at the *Palais de la Découverte* in Paris in September 2009. Almost 140 budding young scientists, mainly from Europe but also from China, Japan and the United States, took part. All participants had to defend their work before a jury. Various prizes were awarded to the best candidates at the end of the competition.

Courtney's prize was a week at CERN. "I didn't really know what to expect before I got here", she told us. "I was simply curious to discover new things". For the record, Courtney has not always been mad about physics. "You might be surprised to learn that I didn't like physics at all before I started studying the subject. But I gradually learnt about its different facets and today I'm really passionate about it."

Courtney has several strings to her bow, which will stand her in good stead for the future. She is not only studying physics but is interested in communication and would ultimately like to find a job that combines the two. "Physics is a very big discipline so it should be possible to combine it with another field. In life it's important to do what you enjoy and to acquire the means to do so", she concludes. And to start as she means to continue, she is already planning to apply for the 2011 Summer Student programme. We wish her a long and happy career and look forward to seeing her back at CERN in the near future.

CERN Bulletin

CAS Accelerator Physics (RF for Accelerators) in Denmark

The CERN Accelerator School (CAS) and Aarhus University jointly organised a specialised course on RF for Accelerators, at the Ebeltoft Strand Hotel, Denmark from 8 to 17 June, 2010.

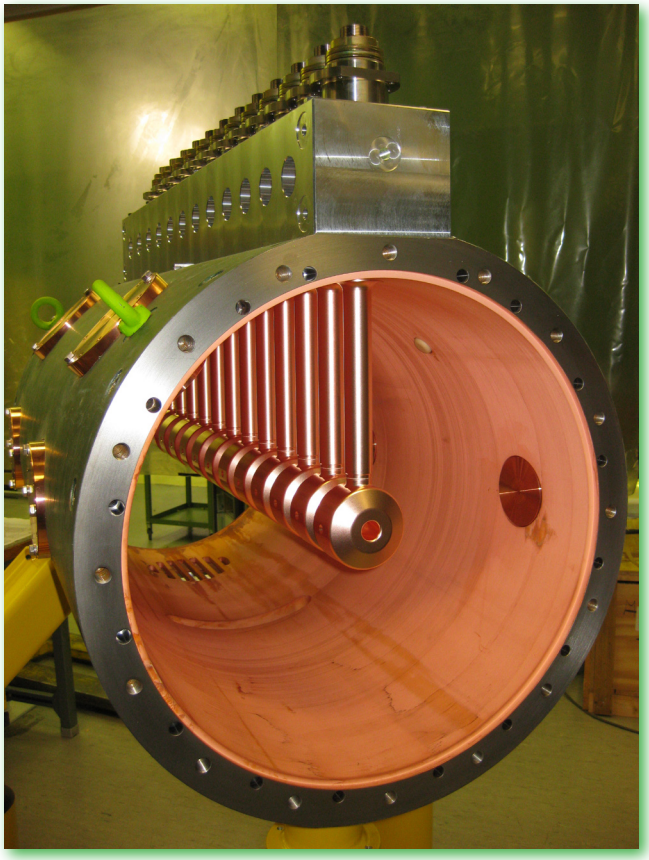
The challenging programme focused on the introduction of the underlying theory, the study and the performance of the different components involved in RF systems, the RF gymnastics and RF measurements and diagnostics. This academic part was supplemented with three afternoons dedicated to practical hands-on exercises.
The school was very successful, with 100 participants representing 25 nationalities. Feedback from the participants was extremely positive, praising the expertise and enthusiasm of the lecturers, as well as the high standard and excellent quality of their lectures.
In addition to the academic programme, the participants were able to visit a small industrial exhibition organised by Aarhus University and take part in a one-day excursion consisting of a visit of the accelerators operated at the Aarhus University and a boat trip on the Silkeborg Lakes ending with a walk to the peak of the Sky Mountain.
The next specialised CAS course will be on "High Power Hadron Machines" and will take place in Bilbao, Spain in the spring of 2011. Information will shortly be available on the CAS web site (https://www.cern.ch/schools/CAS).

Barbara Strasser

The invention that is shaping Linac4

Accelerator experts are no strangers to innovative optimizations of existing techniques and to the development of novel solutions. Sometimes, they even come up with ideas that have the potential to revolutionize the field. This is the case with the Tolerance Aligned Cantilever Mounting (TACM) system, a completely new way of supporting the drift tubes, one of the core elements of linear accelerators. The new, patent-pending technique will be implemented at Linac4.

"Assemble and adjust" – that was the technique used to build drift-tube linacs before the arrival of the TACM. Now, the inventors' motto has become 'adjust and assemble'. The inversion of these two words represents a real revolution for people working in the field. "The drift tubes are a critical element of Linac4 and they have to satisfy several requirements: they have to be mechanically stable and very reliable. And they must need very little maintenance over the years as they are at the beginning of the injection chain for the larger accelerators", says Maurizio Vretenar, Linac4 project leader. "We started from two different design solutions but very quickly realized that, in order to meet the requirements, we needed something new."



The drift tubes for LINAC4, assembled using the new TACM technology.

After several brainstorming meetings with the experts from the CERN Design Office, Pierre Bourquin and Yves Cuvet, and subsequent prototyping, the TACM came to life. "With this new technique, we make all the adjustments to the drift tubes' positioning and alignment before installing them in the vacuum tank. In this way, we achieve a very high accuracy – better than one tenth of a millimetre – while ensuring leak-tightness and good electric contacts", explains Suitbert Ramberger, project engineer for the Linac4 drift tube linac. The alignment of the drift tubes (see illustration) is an extremely critical parameter for a linear accelerator as any imperfection in the assembly and positioning process can potentially lead to beam losses.

Some acceleration facilities under construction around the world, such as the ESS test facility in Bilbao (Spain) and the large European Spallation Source (ESS) in Lund (Sweden), are potential users of the TACM technology of Linac4 developed at CERN. "At the beginning we presented our new ideas and methodologies at the various conferences but we soon realized that this technology could also be of interest to companies that build accelerators used in fields other than fundamental research", says Maurizio Vretenar.

To protect the original ideas and also have some control over who uses them, CERN has filed a patent application for the new technology. "Our policy is to allow free access to CERN's collaborating partners, but having a patent will increase the commercial potential of the technology and give us better control of the dissemination. Our aim is to make this technology available to others", confirms Henning Huuse, Patent Portfolio Manager.

If you are at CERN and are in the process of inventing a new technology or have found an innovative solution to a process, read the article on the next page and do not hesitate to contact the KTT group. It's easy, straightforward and rewarding!

More information about LINAC4 and drawings of the Cantilever can be found at:

http://technologytransfer.web.cern.ch/technologytransfer/en/Technology/mounting_system.html

Watch the video at:

http://cdsweb.cern.ch/record/1281705

CERN Bulletin

Transfer your ideas to society!

Science and technology labs are the ideal places for developing innovative solutions. However, inventors sometimes don't realize that their ideas can find an application in industry, which can in turn have a technical and economic impact on society. Some researchers may think that disclosing an invention is a time-consuming process which is worth doing only in very special cases. But one thing is certain: it is always worth informing the Knowledge and Technology Transfer group, as they will give you the correct advice and support. Don't be afraid of the paperwork… it can be highly rewarding!

Why should researchers at CERN bother to disclose their inventions to the Knowledge and Technology Transfer Group first? "Because when inventors do so, a process to transfer the technology to industry is set in motion" explains Henning Huuse, Patent Portfolio Manager in the KTT Group. To facilitate this transfer, patent protection can be a useful tool. "CERN files patents when there is a potential for commercial exploitation and we believe that having a patent helps attract industry", adds Huuse.

Evidently, in order to be patented, a technology needs to be inventive and must not yet have been disclosed publicly. Indeed, inventors often face a dilemma: they wish to publish papers about their work as soon as possible so that the community recognizes their achievements. Unfortunately, once they've done that, patenting may no longer be possible. "It is advisable to come to us as soon as possible", says Henning Huuse. "In this way, we can evaluate the actual potential of the novel technology and whether or not it should be protected. If details about the technology have already been made publicly available it may be too late".

However, patenting does not prevent you from publishing. Once a patent application has been filed, you can freely publish the content. Some researchers believe that patenting prevents wide dissemination of their scientific results and is in conflict with CERN's long-standing policy to make the results of its work available to the public. "Patenting does not contradict this, and it is our experience that in many cases a patent will increase the probability of a technology being picked up by industry and made available on the market. This is particularly the case when a technology needs further investment before it becomes a product", says Henning Huuse. "Furthermore" he adds, "being named in a patent extends the inventor's recognition from science to industry."

Last but not least, disclosing a technology does not require much paperwork, and the KTT Group is there to support you in this stage too. So don't hesitate: if you are developing a new technique, get in touch with the KTT group for professional advice.

CERN Bulletin

Take note

REMOVALS

Please note that the mail service has moved to Building 555 and the shuttle service to the Building 589.

GS Department - SEM-LS Group

Seminars

MONDAY 2 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
GLOBE 1ST FLOOR
09:15 - Accelerators and Cancer Therapy

U. AMALDI / TERA FOUNDATION

10:15 - Future Linear Colliders : Accelerator Physics

F. TECKER

11:15 - Beyond the Standard Model (Theoretical Particle Physics) (1/5)

G. DVALI

12:00 - Discussion Session

A&T SEMINAR
14:15 - BE Auditorium Meyrin, Bldg. 6-2-024
An Overview of the iThemba LABS Facilities

R. THOMAE / ITEMBA LABS, SOUTH AFRICA

TUESDAY 3 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
GLOBE 1ST FLOOR
09:15 - Initial Data at the LHC Experiments (1/2)

T. LECOMPTE

10:15 - CP Violation (1/4)

G. RAVEN / NATUURKUNDIG LABORATORIUM-VRIJE UNIVERSITEIT (VU)

11:15 - Beyond the Standard Model (Theoretical Particle Physics) (2/5)

G. DVALI

12:00 - Discussion Session (1/2)

TH STRING THEORY SEMINAR
14:00 - TH Auditorium, Bldg. 4
Effective Holographic Theories for low temperature Condensed Matter systems

E. KIRITSIS

COMPUTING COLLOQUIUM
14:30 - Filtration Plant Conference Room, Bldg 222
Innovation Concepts in Healthcare

H. REQUARDT / SIEMENS AG

WEDNESDAY 4 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
GLOBE 1ST FLOOR
09:15 - Initial Data at the LHC Experiments (2/2)

T. LECOMPTE

10:15 - CP Violation (1/4)

G. RAVEN / NATUURKUNDIG LABORATORIUM-VRIJE UNIVERSITEIT (VU)

11:15 - Beyond the Standard Model (Theoretical Particle Physics) (3/5)

G. DVALI

12:00 - Discussion Session (2/2)

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

M. KARCIAUSKAS / LANCASTER UNIVERSITY

TH THEORETICAL SEMINAR
14:00 - TH Auditorium, Bldg. 4
Technicolor and conformal window on the lattice

K. RUMMUKAINEN / UNIVERSITY OF HELSINKI

THURSDAY 5 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
GLOBE 1ST FLOOR
09:15 - The Search Beyond the Standard Model (Theoretical Partic-la Physics) (1/2)

A. DE ROECK / CERN

10:15 - CP Violation (3/4)

G. RAVEN / NATUURKUNDIG LABORATORIUM-VRIJE UNIVERSITEIT (VU)

11:15 - Beyond the Standard Model (Theoretical Particle Physics) (4/5)

G. DVALI

12:00 - Discussion Session (1/2)

Seminars

FRIDAY 6 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
GLOBE 1ST FLOOR
09:15 - The Search Beyond the Standard Model (Theoretical Partícla Physics) (2/2) - A. DE ROECK / CERN

10:15 - CP Violation (4/4)
G. RAVEN / NATUURKUNDIG LABORATORIUM-VRIJE UNIVERSITEIT (VU)

11:15 - Beyond the Standard Model (Theoretical Particle Physics) (5/5)
G. DVALI

12:00 - Discussion Session (2/2)

MONDAY 9 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
GLOBE 1ST FLOOR
09:15 - Neutrino Physics (1/4)
A. ROMANINO / SISSA/ISAS & INFN

10:15 - Introduction to Statistics (1/4) - G. COWAN / ROYAL HOLLOWAY COLLEGE-UNIVERSITY OF LONDON

11:15 - Introduction to Nuclear Physics (1/4) - H. GOUTTE / CEA

12:00 - Discussion Session (1/4)

COMPUTING SEMINAR
11:00 - IT Auditorium, Bldg. 31-3-004
Moodle: How we built a community around open source software
M. DOUGIAMAS / MOODLE

TUESDAY 10 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
GLOBE 1ST FLOOR
09:15 - Neutrino Physics (2/4)
A. ROMANINO / SISSA/ISAS & INFN

10:15 - Introduction to Statistics (2/4) - G. COWAN / ROYAL HOLLOWAY COLLEGE-UNIVERSITY OF LONDON

11:15 - Introduction to Nuclear Physics (2/4) - H. GOUTTE / CEA

12:00 - Discussion Session (2/4)

CERN JOINT EP/PP SEMINARS
11:00 - ???
The Lamb shift in muonic hydrogen - F. LARSEN / UNIVERSITY OF MICHIGAN

WEDNESDAY 11 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
GLOBE 1ST FLOOR
09:15 - Neutrino Physics (3/4)
A. ROMANINO / SISSA/ISAS & INFN

10:15 - Introduction to Statistics (3/4)
G. COWAN / ROYAL HOLLOWAY COLLEGE-UNIVERSITY OF LONDON

11:15 - Introduction to Nuclear Physics (3/4)
H. GOUTTE / CEA

12:00 - Discussion Session (3/4)

17:00 - Poster Session

TH THEORETICAL SEMINAR
14:00 - TH Auditorium, Bldg. 4
TBA [Perspectives in LQCD]
A. UKAWA / CENTER FOR COMPUTATIONAL SCIENCES AND INSTITUTE OF PHYSICS, UNIVERSITY OF TSUKUBA

THURSDAY 12 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
GLOBE 1ST FLOOR
09:15 - Neutrino Physics (4/4)
A. ROMANINO / SISSA/ISAS & INFN

10:15 - Introduction to Statistics (4/4)
G. COWAN / ROYAL HOLLOWAY COLLEGE-UNIVERSITY OF LONDON

11:15 - Introduction to Nuclear Physics (4/4)
H. GOUTTE / CEA

12:00 - Discussion Session (4/4)

TH BSM FORUM
14:00 - TH Auditorium, Bldg. 4
TBA - G. GIUDICE / CERN

FRIDAY 13 AUGUST

SUMMER STUDENT LECTURE PROGRAMME
GLOBE 1ST FLOOR
09:15 - Programme Introduction / Closing Lecture
C. RUBBIA

MONDAY 16 AUGUST

THE FIRST HEAVY ION COLLISIONS AT THE LHC - HIC10
08:00 - TH Auditorium, Bldg. 4

TUESDAY 17 AUGUST

THE FIRST HEAVY ION COLLISIONS AT THE LHC - HIC10
08:00 - TH Auditorium, Bldg. 4

SUMMER STUDENT LECTURE PROGRAMME
GLOBE 1ST FLOOR
09:15 - Student Session (1/9)
10:15 - Student Session (2/9)
11:15 - Student Session (3/9)

WEDNESDAY 18 AUGUST

THE FIRST HEAVY ION COLLISIONS AT THE LHC - HIC10
08:00 - TH Auditorium, Bldg. 4

SUMMER STUDENT LECTURE PROGRAMME
GLOBE 1ST FLOOR
09:15 - Student Session (4/9)
10:15 - Student Session (5/9)
11:15 - Student Session (6/9)

TH THEORETICAL SEMINAR
14:00 - TH Auditorium, Bldg. 4
TBA [Heavy Ion TH Institute]

THURSDAY 19 AUGUST

THE FIRST HEAVY ION COLLISIONS AT THE LHC - HIC10
08:00 - TH Auditorium, Bldg. 4

SUMMER STUDENT LECTURE PROGRAMME
GLOBE 1ST FLOOR
09:15 - Student Session (7/9)
10:15 - Student Session (8/9)
11:15 - Student Session (9/9)

TH BSM FORUM
14:00 - TH Auditorium, Bldg. 4
TBA
M. VOS / IFIC, VALENCIA