CERN Bulletin

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CERN CASTS NEW LIMITS ON DARK MATTER

CAST, CERN's axion solar telescope, moves on its rail to follow the Sun (Image: Max Brice/CERN)

In a paper published on 1 May in *Nature Physics*, the CERN Axion Solar Telescope experiment (CAST) at CERN presented new results on the properties of axions – hypothetical particles that would interact very weakly with ordinary matter and therefore could explain the mysterious dark matter that appears to make up most of the matter in the universe.

Axions were postulated by theorists decades ago, initially to solve an important issue in the Standard Model of particle physics related to the differences between matter and antimatter – the so-called charge-parity violation – that are typical of processes regulated by the weak force, but that haven't been detected in processes involving the strong force. The particle was named after a brand of washing detergent, since its existence would allow the theory to be "cleaned up".

A variety of Earth- and space-based observatories are searching possible locations where axions could be produced, ranging from the inner Earth to the galactic centre and right back to the Big Bang.

CAST is looking for axions from the sun using a special telescope called a helioscope constructed from a test magnet originally built for the Large Hadron Collider. The 10-metre-long superconducting magnet acts like a viewing tube and is pointed directly at the sun: any solar axions entering the tube would be converted by its strong magnetic field into X-ray photons, which would be detected at either end of the magnet by specialised detectors.

(Continued on page 2)

A WORD FROM THE DIRECTOR GENERAL

CONSIGNING INTOLERANCE TO HISTORY

CERN is a diverse, tolerant and respectful place to work, but we are not immune to the kind of blatantly sexist behaviour that should have been consigned to history a long time ago. Three recent events unfortunately show that unacceptable intolerant behaviour can still rear its ugly head at CERN.

(Continued on page 2)

In this issue

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A WORD FROM THE DIRECTOR GENERAL

CONSIGNING INTOLERANCE TO HISTORY

The three cases involved a pregnant woman being told that she should not be at work, wolf-whistling in a public place, and a young female researcher being subjected to repeated sexist behaviour in the workplace. For the vast majority of us, that is a cause for concern, and should we witness such behaviour, it is our duty to do something.

The CERN Code of Conduct, launched in 2010, lays out clearly how we should behave at work, how we should treat others, and how we can expect to be treated by our colleagues. It is all about mutual respect and understanding. Through the Code of Conduct, supervisors are expected to create and nurture a positive and inclusive work environment, free from discrimination and respectful of difference. It is incumbent on all of us to ensure that diversity is cherished as a fundamental value of this Organization, with zero tolerance for sexist, homophobic or racist behaviour.

So what should we do if we witness or are subject to behaviour that goes against the Code of Conduct? As witnesses, we should gently intervene to show our support for the victim, and not stand idly by. If we witness the kind of unthinking casual sexism, racism or homophobia that is unfortunately still too prevalent in today's society, we might have a quiet word with the perpetrator. And whether witness or victim, we should report the incident, since it is only by doing so that we can address the underlying issues.

There are many ways to report incidents of unacceptable behaviour. You can report them to your supervisor, to the Ombudsperson, to the Diversity Office, to the Medical Service, to your HR contact, or to the Social Affairs Service. You can also simply fill in an incident report on the CERN Service Portal. Notwithstanding the three recent incidents, intolerant behaviour is fortunately very rare at CERN. Nevertheless, every incident is a serious breach of the Code of Conduct and, for the victims, every incident is distressing. So let's work together towards a future in which all forms of intolerant behaviour can truly be consigned to history.

Fabiola Gianotti
Director-General

CERN CASTS NEW LIMITS ON DARK MATTER

Since 2003, the CAST helioscope, mounted on a movable platform, has tracked the movement of the sun for an hour and a half at dawn and an hour and a half at dusk, over several months each year. The detector is aligned with the sun with a precision of about one hundredth of a degree.

In the paper published today, based on data recorded between 2012 and 2015, CAST finds no evidence for solar axions. This has allowed the collaboration to set the best limits to date on the strength of the coupling between axions and photons for all possible axion masses to which CAST is sensitive. "The limits concern a part of the axion parameter space that is still favoured by current theoretical predictions and is very difficult to explore experimentally," explains the deputy spokesperson for CAST, Igor Garcia Irastorza. "For the first time, we have been able to set limits that are similar to the more restrictive constraints set by astrophysical observations," he says.

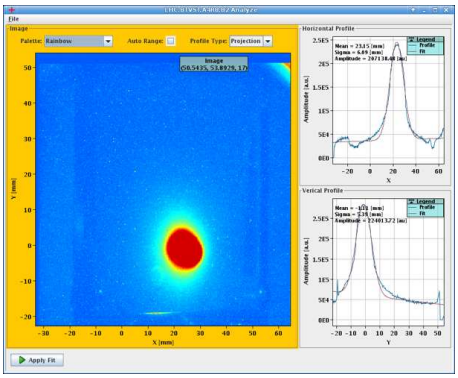
Since 2015, CAST has broadened its research at the low-energy frontier to include searches for other weakly-interacting particles from the dark energy sector, such as "solar chameleons". The experience gained by CAST over the past 15 years will also help physicists define the detection technologies suitable for a proposed, much larger, next-generation axion helioscope called IAXO.

"Even though we have not been able to observe the ubiquitous axion yet, CAST has surpassed even the sensitivity originally expected, thanks to CERN's support and unrelenting work by CASTers," says CAST spokesperson Konstantin Zioutas. "CAST's results are still a point of reference in our field."

More information on the results can be found in the scientific paper (*http://www.nature.com/nphys/journal/vaop/ncurrent/full/nphys4109.html*).

Stefania Pandolfi

LHC REPORT: GEARING UP THE LHC FOR PHYSICS



The single-bunch low-intensity beam seen on a BTV screen. The passage of the LHC beam leaves a nice round spot on the screen. Here the spot is not fully round as it is composed of two beam hits, one after injection and one after one turn around the LHC.

The Large Hadron Collider (LHC) is awake. On Saturday, 29 April, just after 8 p.m., it began circulating beams of protons for the first time in 2017, two days earlier than originally foreseen.

On the road to putting the LHC back into operation, during the last week of April, the powering test period gradually gave way to the machine check-out. This is the phase where all equipment is operationally available and all the pieces of the puzzle fall into place to complete the image.

One of the main steps of the machine check-out is the closure of the Beam Interlock System (BIS) loop, which requires all equipment to be in the operational state and the four experimental caverns to be patrolled and closed. Actually, everything must be set up as if the machine would be ready to receive beam. On Friday, 28 April, the machine and all its power converters were tested – cycled – from injection to acceleration, all the way to the flat-top and the squeeze phase, as if there was beam in the machine. After a few attempts and the resolution of some pending issues, the loop could finally be closed during the night of Friday, 28 to Saturday, 29 April, just before the long weekend. Many checks were made in parallel on all other systems required for beam operation.

In the meantime, the SPS crew worked hard to get the extraction of the single bunch beam from long straight sections 4 and 6 working for the commissioning with beam of the LHC. Initially the beam was sent successfully to the beam dumps close to the SPS, before going down though the TI2 and TI8 transfer lines to the LHC. By the end of the afternoon on Friday, the beam had been successfully sent down both transfer lines, knocking at the LHC's door.

The first LHC beam injection was foreseen for Monday, 1 May. Given the impressive advancement that had been made prior to the long weekend, a first attempt was made to get everything ready on the morning of Saturday, 29 April to inject the beam. Unfortunately, a few issues were discovered at the last minute that delayed the injection. Thanks to the dedication of equipment specialists who worked over the long weekend, the issues were successfully solved in one day.

At 6 p.m., the first injection of beam 1 (clockwise direction) was started. The beam was then brought around the machine step-wise, going one sector further each time. Just 45 minutes later, the beam went all the way round and was circulating. Beam 2 (anti-clockwise direction) then went through the same process, and at 8.12 p.m., both beams were circulating, two days ahead of schedule.

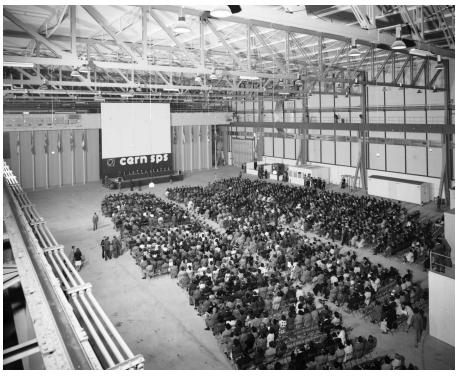
Then, on the afternoon of Sunday, 30 April, the circulating single-bunch low-intensity beams were successfully accelerated up to 6.5 TeV per beam.

This remarkable achievement was made possible thanks to the good preparation of the machine and all its sub-systems by the equipment experts and the dedication of several experts in close collaboration with the operations teams in the CCC over the long holiday weekend.

Now the work continues with the detailed setting-up of the machine, initially with low-intensity single bunches and later with higher-intensity and then multiple bunches, to validate each step in the process, after which collisions can be made safely and physics can start in a few weeks' time.

Rende Steerenberg for the Operations group

BEHIND THE SCENES OF THE SPS'S 40TH BIRTHDAY



On 7 May 1977, around 2000 people gathered at CERN for the inauguration of the Super Proton Synchrotron. (Image: CERN)

Forty years ago, on 7 May 1977, CERN inaugurated the world's largest accelerator at the time – the Super Proton Synchrotron. The first beam of protons had already circulated around the seven kilometres of the accelerator in May of the previous year, and future research would include the Nobel-Prize-winning discovery of W and Z particles in 1983, when the machine was running as a proton-antiproton collider. The inauguration of the SPS gathered around 2000 people at CERN. A selection of brochures, press releases, photos, and audio-visual material available online in the CERN Document System helps to recreate the event.

But what was happening behind the scenes? Did you know that the organising secretary, Ella Steel, universally known as "Miss Steel", set up a massive card index to keep track of the guests, entering all the details on 6000 colour-coded cards? She also insisted on sending reply cards to the VIPs, even though treating them like ordinary mortals was considered demeaning. "The higher you go in a hierarchy, the less legible signatures become," she used to say, as she wanted to know who the replies came from. Logistics were further complicated by differing ideas in the different countries as to what constituted an "official delegate".

It's all in her report, which is in the CERN Archive, along with another 1000 or so shelf metres of files filled with letters, notes, reports, rough drafts, memos and plenty more. Miss Steel's "ant's-eye view", as she called it, is a trivial example, but the view behind the scenes is crucial. Without this, our understanding of past events is based solely on what was intended for public consumption, and history becomes just what was written by the winners.

Archival documents are a remarkable resource. They are the documentary by-product of human activity, the records generated by individuals and organisations over the ordinary course of their lives, and are an irreplaceable testimony to past events. For organisations such as CERN, archives provide a corporate memory that can be preserved while human memories fade. Not everything is kept, of course; in general, between 5 and 10% of the records produced by an organisation might be considered worth preserving for historical reasons.

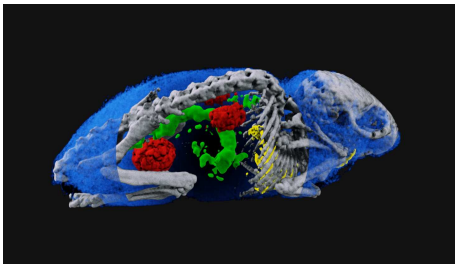
Historic documents are precious, but they are also vulnerable. They are easily damaged or lost, and a scrawled note that changed the design concept for a project decades ago would make little sense removed from its context – the surrounding documents help us understand who wrote it, when and why.

Archives provide historical information to support ongoing activity, and the CERN Archive is consulted by researchers within and outside the organisation. Effective management of records and archives also underpins good governance, administrative transparency, the identity of individuals and communities, the preservation of mankind's collective memory, and access to information by citizens.

If you think there could be information in the CERN Archive that would be useful to you, if you know of material that you think should be preserved in the Archive, or if you are just curious to know more, take a look at our webpages or get in touch (anita.hollier@cern.ch). We're always glad to help if we can.

Anita Hollier

SPECTRAL IMAGING: FROM CERN TO MEDICAL TECHNOLOGIES



Spectral imaging allows colour imaging in CT scans. MARS can measure multiple targeting agents simultaneously. (Image: MARS Spectral Imaging)

Ever since Röntgen discovered X-rays in 1895, physics and medicine have gone hand in hand, and advances made to particle detectors at CERN and elsewhere have continuously fuelled new developments in medical imaging.

The Medipix Collaborations, whose activities started in the 1990s developing a detector technology for the needs of the Large Hadron Collider (LHC) experiments at CERN, have commercialised Medipix in other scientific fields, in particular the medical imaging field.

Medipix works like a camera, counting and detecting each individual particle hitting the pixels when its electronic shutter is open. This enables high-resolution, high-contrast, noise-free images – all reasons that drove most of the LHC experiments to adopt the technology.

Through the Medipix Collaborations, a family of read-out chips for particle detection was developed, and to date there have been three generations of the Medipix chips – each with improvements and new features.

Among a wide range of other applications, Medipix can be used for Computed Tomography (CT) scans. During a CT scan, an X-ray tube is rotated around the patient, resulting in images showing both shape and density. In addition, unlike conventional X-ray images, overlapping structures are eliminated. There are many applications for this technique, but it is especially useful when searching for lesions, tumours and metastasis.

The third generation of read-out chips, named Medipix3, also allows 'colour' imaging during CT scans, or so-called spectral imaging. By sending X-rays of different energies through the object being examined, the Medipix3 chip can detect the photons one-by-one, categorising them according to their energy, thus providing information about the density and the atomic structure of a tissue. For example, while regular non-colour X-ray images from CT scans may show the difference between bones and soft tissue, spectral imaging is better able to distinguish between different materials of similar density. This aids medical staff with diagnosis, as materials that would previously appear the same in an image can now be classified.

At present, spectral imaging has several applications on the market, but it is still in the emerging phase and has not been widely adopted. The start-up company MARS Spectral Imaging is working on spectral molecular imaging technology based on Medipix3. When combined with biological tracers attached to metal nano-particles, their scanners can allow researchers and clinicians to measure biochemical and physiological processes, modelling human diseases in animals. Although still in a pre-clinical phase, meaning that the scanners cannot yet be routinely used on humans, the MARS team has concluded that the technology will be useful in the diagnosis and treatment of heart disease, stroke, arthritis, joint replacements and cancer.

In addition to pictures with new and improved diagnostic information, MARS promises that spectral imaging will enable faster and cheaper radiology procedures while working with significantly lower radiation doses. This will considerably broaden both the value and use of Computed Tomography (CT) as a diagnostic tool, and consequently the potential of spectral imaging technologies has received a lot of attention lately from medical professionals. It is still too early to say if Medipix and MARS will be dominant play-

ers in the field of spectral imaging, but they undoubtedly offer a promising solution in this emerging field.

Find out more at the next Knowledge Transfer seminar: "From High Energy Physics to a Bio-Medical Business", by Anthony Butler, Chief Medical Officer (CMO) in MARS Spectral Imaging here. (*https://indico.cern.ch/event/616390/*)

Ranveig Strom for the KT group

CERN WINS AWARD FOR PIONEERING COMMUNICATIONS

Ana Godinho, Head of CERN's Education, Communications and Outreach group (left, holding the microphne), receives the 2017 Award for Constribution to Science Communication on behalf of CERN from Czech Republic's Academia Film Olomouc

The Czech Republic's Academia Film Olomouc has decided to give its 2017 Award for Contribution to Science Communication to CERN, for its "long-lasting commitment not only to research in the edge of science but also to communication of its results and science in general to broader public". The committee described CERN as a pioneer in developing new ways to communicate science via social media, film, traditional media and events such as CineGlobe. The award ceremony took place on 29 April 2017 at Palacký University Interactive Science Centre in Olomouc.

CO-CREATING HUMANITARIAN FORESIGHT AND FUTURES

#HFFC17 participants from UNOCHA, ICRC, UNHCR, WFP, Terre des Hommes, Handicap International, MSF and many other organizations are co-creating the six humanitarian focal areas for the afternoon workshops. (Image: Geneva Guerin/GHL)

How is the humanitarian sector changing?", "What are the emerging trends and technologies?" and "How can we prepare for the future?" are some of the questions raised at the first Humanitarian Foresight & Futures Co-creation (#HFFC17).

Over 65 participants from more than 25 international organisations, NGOs and permanent missions were hosted by IdeaSquare and welcomed by CERN's Director for International Relations, Charlotte Warakaulle, at #HFFC17 on 4 April. They discussed and defined common thematic areas relating to the future of the humanitarian sector and how to prepare for it.

Designer and internet entrepreneur David Galbraith, CrowdAI scientist Sean Carroll, genomics futurist Juan Enriquez, human-centered innovator Tuuli Utriainen and organisational behavior lecturer Rich Cox gave their opinions on how data, new algorithms, the mobility of work, improved education and the re-shaping of challenges will change the future of the humanitarian sector.

"The inspiring atmosphere of IdeaSquare is ideal for fostering co-creation and the "dare to dream" for strategic humanitarian foresight," said Olivier Delarue, CEO of the Global Humanitarian Lab (GHL).

In the afternoon session, co-creation led to the identification and visualisation of 31 leads for common activities in a "readiness and impact" map. Jean-Marie Le Goff, from CERN Collaboration Spotting, showed how automatic analysis of patents and publications can lead to information on academia and industry key players active around technologies interesting for the humanitarian sector.

A summary video of #HFFC17 can be found here (*http://www.youtube.com/watch?v=raLIW5kmTlo&feature=youtu.be*).

If you have an idea on "How technology or methods used at CERN can improve the effectiveness and preparedness of the humanitarian sector" or are interested in participating in or contributing to the next edition, please contact us here (*http://www.globalhumanitarianlab.org/contactghl/*).

Daniel Dobos

COMPUTER SECURITY: AN ATTACK FOR MORE SECURITY

CERN found itself under heavy attack in summer 2015 with cybercriminals trying to take over PCs and computing accounts and aiming to extract some of our public documents. While the attack only lasted a few days and was visibly not successful in the end, it laid the foundation for an initiative to strengthen CERNs protective measures further.

CERN, with its open, academic culture, has always been susceptible to cyberattacks of many different kinds, as are all companies and institutes worldwide. Thanks to you being vigilant, attacks are usually fought off. Training sessions and awareness-raising campaigns have shown to be fruitful on many occasions. Still, there is room for improvement (see our *Bulletin* article on "One click and BOOM... (Reloaded)"). Computer security is a moving target and defensive measures need continual adaptations and adjustments. The aforementioned attack in summer 2015 and the 2016 Crisis Management Exercise by CERN's senior management triggered increased efforts to raise our defences. Thanks to the support of the CERN Management, four important security initiatives were launched:

* The mail service, in collaboration with the Computer Security team, has deployed a dedicated appliance that automatically analyses all our e-mails for malicious content (see also "Protect your click"). Our FireEye EX device even simulates user activity trying to trigger any malicious activity in the e-mails sent to us. It is now in full operation and many waves of malware such as the Dridex banking malware have been prevented from arriving in your inbox.

* For those mails that still make it through, the IT department's Windows team has started deploying specially hardened Windows PCs for those colleagues who have to open unsolicited attachments regularly, in particular PDF files. If infected, those PDFs will certainly compromise the PC and the local computing accounts. Hardened Windows PCs are less susceptible to infection thanks to a suite of additional protective measures (e.g. administrator rights removed, an alternative PDF reader installed, phasing-out of Flash, execution restrictions for macros and local commands). A pilot is already running with our colleagues in the Finance and Human Resources sector. A big thank you to all participants!

* Thanks to a collaboration between the Accelerator and Technology sector and the IT department, additional access protections are on the horizon: multi-factor authentication (the use of a hardware token in addition to your password) is currently being investigated so that it can be deployed on dedicated Windows and Linux Bastion hosts (see also our article "Pimp up your password"). Those Bastion hosts (bastions indeed!) will become gateways for any interactive remote access into CERN's accelerator network (i.e. the "Technical Network") as well as for administrator access to CERN's Data Centre.

* Finally, in line with a new strategy defined by the Beams department and the CNIC (Computing and Networking Infrastructure for Controls) working group, our colleagues from the OpenStack virtualisation service have started looking into ways to provide dedicated virtual machines for the control system development on the accelerator network. While those virtual machines are currently located on CERN's office network, they should virtually move closer to the control system devices to ease development and testing.

Of course, we are trying to make all these extra measures as convenient and transparent as possible for you and your daily work. Still, we are counting on your support to ensure that CERN's operations proceed in the most secure fashion.

Do you want to learn more about computer security incidents and issues at CERN? Follow our Monthly Report (http://cern.ch/security/reports/en/monthly_reports.shtml). For further information, questions or help, visit our website (http://cern.ch/Computer.Security) or contact us at Computer.Security@cern.ch.

The Computer Security Team

THE AFRICAN SCHOOL OF PHYSICS: A SPRINGBOARD FOR THE FUTURE

A biennial African School of Physics (ASP) on fundamental physics and its applications was established in 2010 in order to promote international cooperation in the field of fundamental physics among African countries and between them and western countries.

An ASP has taken place every second year from 2010 to 2016, in South Africa, Ghana, Senegal and then Rwanda. The schools are based on a close interplay between theoretical, experimental and applied physics and grid computing. They cover a wide range of topics: from particle physics and particle detectors to astroparticle physics and cosmology and to computing and accelerator technologies. Scientists from Africa, Europe, Asia and the USA are invited to deliver lectures, taking into account the diverse levels and backgrounds of the students.

After each edition of the school, the ASP organising committee maintains contact with the students and mentors and coaches them as much as possible in their pursuit of higher education. In addition, the organising committee runs a mentorship program for active coaching of a few selected promising students.

Many ASP alumni are able to continue their studies at CERN, as summer school students, postgraduate students or postdoctoral fellows.

For example, Chilufya Mwewa, from Zambia, is a PhD student from the University of Cape Town. She attended ASP2010. "Intrigued by the many things I learned at this school, I considered pursuing a career in particle physics. I was able to work in collaboration with CERN scientists and thanks to the ASP network," she says. She was awarded an ATLAS PhD grant and is currently working on the ATLAS Muon New Small Wheel and Standard Model physics at CERN.

Diallo Boye, from Senegal, attended ASP2012. He is student at the University of Johannesburg and he is now working as a PhD student on the ATLAS Muon New Small Wheel and on searches for Higgs decays to Beyond Standard Model particles. "Attending ASP basically initiated the start of my career in particle physics," he happily notes.

Hyafa Sfar, from Tunisia, attended ASS2016 and she is now working at CMS as a PhD student. "ASP has given me a great opportunity to start up my PhD in the field of particle physics," she remarks.

The fifth edition of ASP will take place in 2018 in Namibia, supported through a partnership with several Namibian and international institutes and organisations.

For more information, contact the ASP International Organising Committee at asp-ioc@cern.ch.

Stefania Pandolfi and Kétévi Assamagan

CERN ROADSHOW IN FINLAND

A unique event called the CERN Roadshow in Finland took place on 6 April 2017. Organised by the Helsinki Institute of Physics (HIP) and CERN, the Roadshow brought together members of the CERN and HIP managements alongside experts from CERN in the fields of procurement, knowledge transfer and human resources, at the Aalto University Design Factory in Otaniemi, Finland.

The Roadshow was targeted at potential CERN business and R&D&I partners, career service professionals and other Finnish stakeholders in CERN. Its main goal was to present to the local community the numerous business, educational, knowledge transfer, job and traineeship opportunities that CERN has to offer.

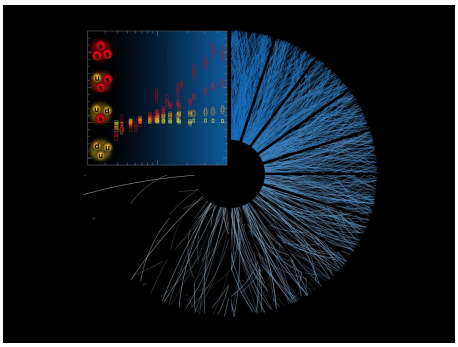
Finland has long traditions and established competences in natural sciences, high technology field research and the associated industrial activities. Finnish scientists, companies and students have been successfully working with CERN since the ratification of Finland's membership in 1991. During the event, industrial companies such as Advacam, Lightneer, Luvata and Mirion Technologies presented their experience of doing business and co-innovating with CERN.

Charlotte Warakaulle, Director of International Relations at CERN, took part in one of the highlights of the event – the launch of Lightneer Ltd's physics learning game.

The Roadshow was attended by representatives of the Finnish Ministry of Education and Culture, the Ministry of Economic Affairs and Employment, the Academy of Finland, and the Finnish Funding Agency for Innovation. Fruitful meetings between 51 company executives from 42 high tech field companies, university career councillors and directors from 23 universities yielded many initiatives for future collaboration.

Encouraged by the positive feedback from the participants, the event organisers are already preparing for Finland@CERN, a similar meeting that will take place from 1 to 3 November 2017 at IdeaSquare and the Globe of Science and Innovation, as part of Finland's centenary celebration year.

NEW ALICE RESULTS SHOW NOVEL PHENOMENA IN PROTON COLLISIONS



As the number of particles produced in proton collisions (the blue lines) increase, the more of these so-called strange hadrons are measured (as shown by the orange to red squares in the graph) (Image: ALICE/CERN)

In a paper published on 24 April 2017 in Nature Physics, the ALICE collaboration reports that proton collisions sometimes present similar patterns to those observed in collisions of heavy nuclei. This behaviour was spotted through observation of so-called strange hadrons in in certain proton collisions in which a large number of particles are created, using the 7 TeV proton collision data from LHC run 1.

Strange hadrons are well-known particles with names names such as Kaon, Lambda, Xi and Omega, all containing at least one strange quark. The observed 'enhanced production of strange particles' is a familiar feature of quark-gluon plasma, a very hot and dense state of matter that existed just a few millionths of a second after the Big Bang, and is commonly created in col-

lisions of heavy nuclei. But it is the first time ever that such a phenomenon – the enhanced production of strange particles – is unambiguously observed in the rare proton collisions in which many particles are created. This result is likely to challenge existing theoretical models that do not predict an increase of strange particles in these events.

The study of the quark-gluon plasma provides a way to investigate the properties of strong interaction, one of the four known fundamental forces. The quark-gluon plasma is produced at very high temperature and energy density, when ordinary matter undergoes a transition to a phase in which quarks and gluons become 'free' and are thus no longer confined within hadrons. These conditions can be obtained at the Large Hadron Collider by colliding heavy nuclei at high energy.

Before this study, enhanced strangeness production has been observed only in collisions of heavy nuclei, and it is considered as a manifestation of quark-gluon plasma. ALICE's result indicates that this phenomenon may now have been observed within proton-proton collisions as well.

The new results also show that the production rate of these strange hadrons increases with the 'multiplicity' – the number of particles produced in a given collision – faster than that of other particles generated in the same collision. In addition, data show that the higher the number of strange quarks contained in the induced hadron, the stronger is the increase of its production rate. No dependence on the collision energy or the mass of the generated particles is observed, demonstrating that the observed phenomenon is related to the strange quark content of the particles produced.

"We are very excited about this discovery," said Federico Antinori, Spokesperson of the ALICE collaboration. "We are again learning a lot about this primordial state of matter. Being able to isolate the quark-gluon-plasma-like phenomena in a smaller and simpler system, such as the collision between two protons, opens up an entirely new dimension for the study of the properties of the fundamental state that our universe emerged from."

Announcements

RENOVATION OF THE CROSSROADS IN FRONT OF THE PRÉVESSIN SITE

The crossroads in front of the main entrance of the Prévessin site will be renovated during the period between **1 May and 30 October 2017**. The works will unfold in three phases.

During the first phase, from 1 May to 1 July, the networks located under the new crossroads will be moved. As a result, the main entrance of the Prévessin site **will be closed for three consecutive nights from 7 p.m. to 7 a.m., from 29 May to 2 June.** During these periods, alternative entrances will be available.

The roadworks will take place during the second phase, which will last from 1 July to 31 September 2017. Finally, new traffic lights will be installed by the end of October 2017. Unfortunately some disruption to the traffic flow is expected during these five months.

The new crossroads has been designed by the technical services of the French department of Ain to guarantee traffic capacity over the next 30 years, accounting for a traffic increase of two percent per year. The new design includes more lane preselections with a shorter traffic light cycle.

8 MAY: MODIFICATION OF THE TRAFFIC ON THE ROUTE DE MEYRIN

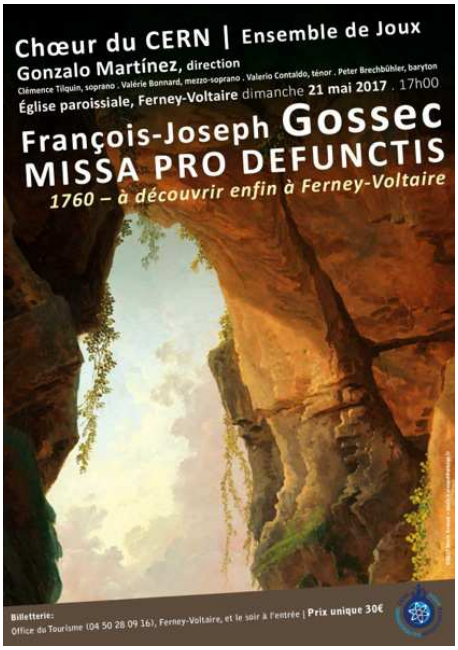
As announced at the beginning of April, the work on the *Esplanade des Particules* will require the traffic on the Route de Meyrin to be diverted. This diversion will be effective as of Monday, 8 May (see the map below).

For more information about the progress of the work, visit the Esplanade des Particules page on the "CERN and its Neighbours" website.

Thank you for your cooperation.

SMB Department

CONCERTS BY CERN CHOIR-ENSEMBLE DE JOUX | 20 & 21 MAY



François-Joseph Gosssec
Missa pro defunctis

Saturday 20 May 2017-8 p.m.
Temple de Saint-Gervais, Geneva
Price: CHF 40

Sunday 21 May 2017-5 p.m.
Église paroissiale, Ferney-Voltaire
Price: 30 €

OPENING HOURS OF CERN RESTAURANTS AND CAFETERIAS

Opening hours of CERN restaurants and cafeterias during the weekends of May 1st, May 25th and June 5th, 2017

During those weekends, only restaurant 1 will remain opened and will apply the usual weekend opening hours, i.e. from 7.00 a.m. until 10.00 p.m. Restaurants 2, 3 and all cafeterias will be closed and will reopen respectively on Tuesday 2 May, Monday 29 May and Tuesday 6 June at their normal opening hours.

RELAY RACE 2017 - THURSDAY 1 JUNE

Obituaries

CHARLES GRUHN (1935 - 2017)

Charles Gruhn, a colleague and friend for many of us at CERN and elsewhere, passed away peacefully on 24 March.

Chuck was a true experimental physicist and throughout his professional life he worked on the development of particle detectors. After gaining a PhD from the University of Washington (1961), he started his scientific career at MIT. He moved on to Michigan State University (1964) and the Max-Planck-Institute for Physics in Munich (1970) before being offered an indefinite contract at CERN.

Chuck left CERN for three years to work at Los Alamos National Laboratory. While at Los Alamos, he registered a US patent for the development of laser beam alignment systems. In 1978, Chuck moved to Lawrence Berkeley Laboratory where he kept a position as professor until his retirement in 1992. LBL was deeply involved in the CERN experiments, allowing Chuck to spend most of his time at CERN.

After his retirement, Chuck became a consultant for the ATLAS experiment. He was the first to study the characteristics of single proportional drift tubes, later to be produced in their hundreds of thousands to form the ATLAS muon spectrometer.

Chuck's main scientific interest during his later years was astronomy and the study of binary stars. He developed methods for their observation and analysis with his own telescope and recorded real data at the international amateur observatory in Namibia.

Although suffering from heart problems, Chuck stayed active. His main remedy against his health problems was hiking in the Jura mountains.

Besides the many achievements in his brilliant scientific career, we would like to recall his large store of fine human qualities. Above all however, his greatest quality was perhaps that he was simply a nice person.

Our deepest sympathy goes to his wife Ute, their children and families.

His friends and colleagues