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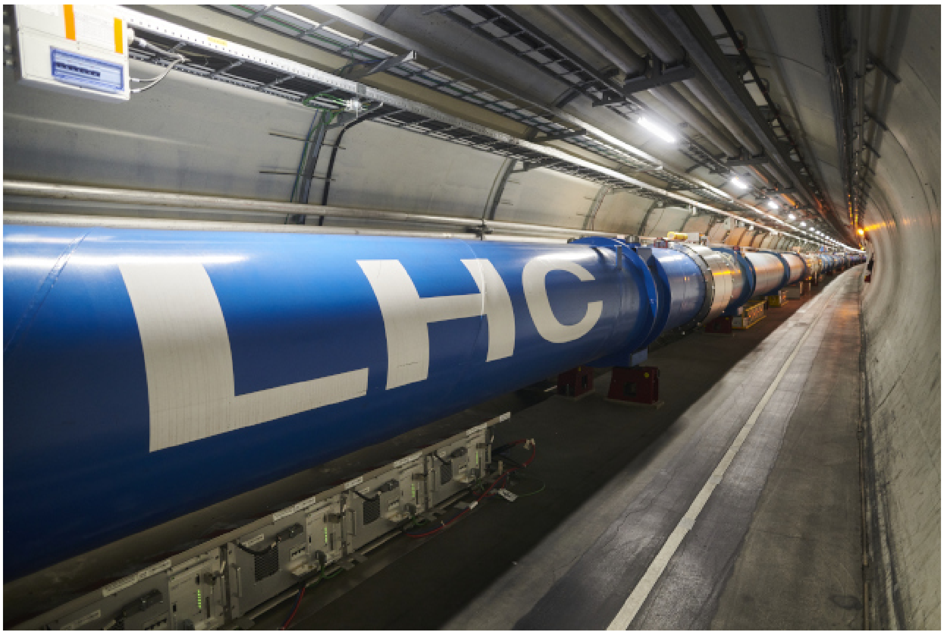
Large Hadron Collider restarts

Beams of protons are again circulating around the collider's 27-kilometre ring, marking the end of a multiple-year hiatus for upgrade work



The LHC tunnel at point 1 (Image: CERN)

The world's largest and most powerful particle accelerator has restarted after a break of more than three years for maintenance, consolidation and upgrade work. Today, 22 April, at 12:16 CEST, two beams of protons circulated in opposite directions around the Large Hadron Collider's 27-kilometre ring at their injection energy of 450 billion electronvolts (450 GeV). "These beams circulated at injection energy and contained a relatively small number of protons. High-intensity, high-energy collisions are a couple of months away," says the Head of CERN's Beams department, Rhodri Jones. "But first beams represent the successful restart of the accelerator after all the hard work of the long shutdown." "The machines and facilities underwent major upgrades during the second long shutdown of CERN's accelerator complex," says CERN's Director for Accelerators and Technology, Mike Lamont. "The LHC itself has undergone an extensive consolidation programme and will now operate at an even higher ene ...

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A word from Raphaël Bello

CERN's innovation can protect our planet: ideas and projects are welcome!

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CERN's innovation can protect our planet: ideas and projects are welcome!

Could CERN innovation be disseminated to tackle environmental challenges on a global scale? The new CERN Innovation Programme on Environmental Applications (CIPEA) provides a framework to support this initiative.

Working at CERN, at the cutting edge of technology, we all know that the potential for innovation is huge. The technologies we develop at CERN to achieve our scientific objectives can and do have multiple applications outside the Laboratory and often address challenges faced by society.

An Organization like CERN, committed to pursuing its mission of research, innovation, training and collaboration and serving as a prime example of international collaboration since its foundation in 1954, must also strive to be a role model when it comes to environmental responsibility.

There are two main ways to play an active and responsible role in this field. The first one is direct and immediate: limiting the negative impact of the Organization's activities on the environment and, in particular, minimising its own carbon footprint. The initiatives launched as part of CERN's year of environmental awareness clearly go in this direction. The second one involves making a conscious effort to harness the unique skill set of the people and the technologies they develop within the Organization in order to maximise their positive impact on the environment globally. The positive return for society will probably be long term, but the potential benefits are boundless.

The CERN Innovation Programme on Environmental Applications (CIPEA) was launched in March with the objective of stimulating and coordinating these efforts. It aims to identify innovative ideas and technologies developed by CERN experts that could be used to help preserve our planet.

Several strategic domains with high potential impact and strong synergies with CERN's technical scope of expertise have been identified:

• renewable and low-carbon energy (production, transformation, distribution, storage)

• clean transportation and future mobility (aviation, shipping, rail and automotive)

• climate change and pollution control (monitoring, modelling, mitigation)

• sustainability and green science (power management, heat management, industrial processes).

Possible examples include superconducting technologies for high-efficiency power transmission, cryogenics and vacuum for advanced hydrogen storage, big data analysis tools for global-scale climate simulations and advanced algorithms for fast and low-power computing.

Could the technologies being developed by your team address major environmental challenges? Could your lab facilities be used to build solutions for a healthier and more sustainable planet? Please, let us know!

The deadline to submit proposals is 27 May. The most promising ideas will be presented to the CERN community and management during the CERN Innovation Day on Environmental Applications in June. These ideas will enjoy the support of the Knowledge Transfer group through internal instruments such as the KT Fund or the CERN Technology Impact Fund. Establishing bilateral partnerships with industrial partners and external stakeholders (e.g. through EU support or national projects) could also help take your idea further.

For more information on how to take part, visit the dedicated webpage (https://kt.cern/environment/CIPEA).

Raphaël Bello

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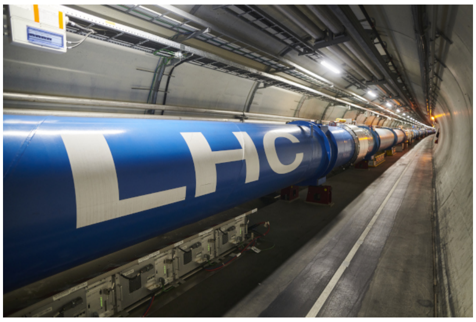

The LHC tunnel at point 1 (Image: CERN)

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"The machines and facilities underwent major upgrades during the second long shutdown of CERN's accelerator complex," says CERN's Director for Accelerators and Technology, Mike Lamont. "The LHC itself has undergone an extensive consolidation programme and will now operate at an even higher energy and, thanks to major improvements in the injector complex, it will deliver significantly more data to the upgraded LHC experiments."

Pilot beams circulated in the LHC for a brief period in October 2021. However, the beams that circulated today mark not only the end of the second long shutdown for the LHC but also the beginning of preparations for four years of physics-data taking, which is expected to start this summer.

Until then, LHC experts will work around the clock to progressively recommission the machine and safely ramp up the energy and intensity of the beams before delivering collisions to the experiments at a record energy of 13.6 trillion electronvolts (13.6 TeV).

This third run of the LHC, called Run 3, will see the machine's experiments collecting data from collisions not only at a record energy but also in unparalleled numbers. The ATLAS and CMS experiments can each expect to receive more collisions during this physics run than in the two previous physics runs combined, while LHCb, which underwent a complete revamp during the shutdown, can hope to see its collision count increase by a factor of three. Meanwhile, ALICE, a specialised detector for studying heavy-ion collisions, can expect a fifty times increase in the total number of recorded ion collisions, thanks to the recent completion of a major upgrade.

The unprecedented number of collisions will allow international teams of physicists at CERN and across the world to study the Higgs boson in great detail and put the Standard Model of particle physics and its various extensions to the most stringent tests yet.

Other things to look forward to in Run 3 include the operation of two new experiments, FASER and SND@LHC, designed to look for physics beyond the Standard Model; special proton–helium collisions to measure how often the antimatter counterparts of protons are produced in these collisions; and collisions involving oxygen ions that will improve physicists' knowledge of cosmic-ray physics and the quark–gluon plasma, a state of matter that existed shortly after the Big Bang.

Videos:

VNR: https://videos.cern.ch/record/2295778 (https://videos.cern.ch/record/2295778)

The LS2 upgrades to the LHC detectors: https://videos.cern.ch/record/2295775 (https://videos.cern.ch/record/2295775)

The LS2 upgrades to the CERN accelerators chain: https://videos.cern.ch/record/2295776 (https://videos.cern.ch/record/2295776)

The LHC and the accelerator complex: here (https://home.cern/resources?title=&topic=1114&type=61&audience=22&field_p_resource_display_tags_target_id=&date_from=&date_to=)

Photos:

Photos of the restart: https://cds.cern.ch/record/2807018 (https://cds.cern.ch/record/2807018)

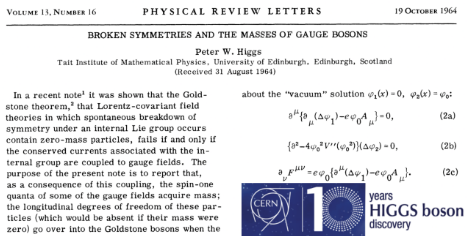
The accelerator complex: https://home.cern/resources/image/accelerators/accelerator-complex-images-gallery (https://home.cern/resources/image/accelerators/accelerator-complex-images-gallery)

The LHC: https://home.cern/resources/image/accelerators/lhc-images-gallery (https://home.cern/resources/image/accelerators/lhc-images-gallery)

Media kit:

https://home.cern/press/2022 (https://home.cern/press/2022)

Higgs@10 – A boson is born



VOLUME 13, NUMBER 16 PHYSICAL REVIEW LETTERS 19 OCTOBER 1964

BROKEN SYMMETRIES AND THE MASSES OF GAUGE BOSONS

Peter W. Higgs

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(Received 31 August 1964)

In a recent note[1] it was shown that the Goldstone theorem,[2] that Lorentz-covariant field theories in which spontaneous breakdown of symmetry under an internal Lie group occurs contain zero-mass particles, fails if and only if the conserved currents associated with the internal group are coupled to gauge fields. The purpose of the present note is to report that, as a consequence of this coupling, the spin-one quanta of some of the gauge fields acquire mass; the longitudinal degrees of freedom of these particles (which would be absent if their mass were zero) go over into the Goldstone bosons when the

about the "vacuum" solution $\varphi_1(x)=0$, $\varphi_2(x)=\varphi_0$:

$$\partial^\mu\{\partial_\mu(\Delta\varphi_1)-e\varphi_0A_\mu\}=0, \tag{2a}$$

$$\{\partial^2-4\varphi_0^{\,2}V''(\varphi_0^{\,2})\}(\Delta\varphi_2)=0, \tag{2b}$$

$$\partial_\nu F^{\mu\nu}=e\varphi_0\{\partial^\mu(\Delta\varphi_1)-e\varphi_0A_\mu\}. \tag{2c}$$

The 1964 Peter Higgs paper that first predicted the existence of what would come to be known as the Higgs boson (Image: APS)

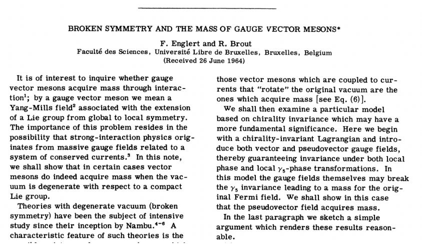
On 4 July 2012, half a century's wait came to an end as the ATLAS and CMS experiments announced the discovery of the Higgs boson. Celebrate 10 years (https://home.cern/news/news/cern/higgs10-save-date) ***since this extraordinary achievement by learning more about the history that led up to it, the next steps in understanding the mysterious particle, and CERN's role in this endeavour. The "Higgs history" series of Bulletin articles will walk you through this journey, starting with an account by CERN Courier editor, Matthew Chalmers, of the theorisation of the Higgs boson in the 1960s.***

It's every theoretical physicist's dream to conjure a new particle from mathematics and have it observed by an experiment. Few have scaled such heights, let alone had a particle named after them. In the CERN auditorium on 4 July 2012, Peter Higgs wiped a tear from his eye when the ATLAS and CMS results came in. The Higgs boson holds the record (48 years) among elementary particles for the time between prediction and discovery, going from an esoteric technicality to commanding the global spotlight at the world's most powerful collider.

Revealing that the universe is pervaded by a stark "scalar" field responsible for generating the masses of elementary particles was never something Robert Brout and François Englert, and independently Peter Higgs, set out to do. Their short 1964 papers – one by Brout and Englert, two others by Higgs – concerned an important but niche problem of the day. "Of no obvious relevance to physics" was how an editor of *Physics Letters* is said to have remarked on rejecting one of Higgs' manuscripts. The papers went from fewer than 50 citations by the turn of the decade to around 18 000 today.

At the time the "BEH" mechanism was being dreamt up independently in Brussels and Edinburgh – and in London by Gerald Guralnik, Carl Hagen and Tom Kibble – the Standard Model of particle physics was years away. Physicists were still trying to understand the menagerie of hadrons seen in cosmic-ray and early accelerator experiments, and the nature of the weak force. The success of quantum electrodynamics (QED) in describing electromagnetism drove theorists to seek similar "gauge-invariant" quantum field theories to describe the weak and strong interactions. But the equations ran into a problem: how to make the carriers of these short-range forces massive, and keep the photon of electromagnetism massless, without spoiling the all-important gauge symmetry underpinning QED.

It took a phenomenon called spontaneous symmetry breaking, inherent in superconductivity and superfluidity, to break the impasse. In 1960, Yoichiro Nambu showed how the "BCS" theory of superconductivity developed three years earlier by John Bardeen, Leon Cooper and John R. Schrieffer could be used to create masses for elementary particles, and Jeffrey Goldstone brought elementary scalar fields to the party, picturing the vacuum of the universe as a "Mexican hat" in which the lowest-energy state is not at the most symmetrical point at the peak of the hat but in its rim. It was an abstraction too far for soon-to-be CERN Director-General Viki Weisskopf, who is said by Brout to have quipped: "Particle physicists are so desperate these days that they have to borrow from the new things coming up in many-body theory like BCS. Perhaps something will come of it."



BROKEN SYMMETRY AND THE MASS OF GAUGE VECTOR MESONS*

F. Englert and R. Brout

Faculté des Sciences, Université Libre de Bruxelles, Bruxelles, Belgium

(Received 26 June 1964)

It is of interest to inquire whether gauge vector mesons acquire mass through interaction[1]; by a gauge vector meson we mean a Yang-Mills field[2] associated with the extension of a Lie group from global to local symmetry. The importance of this problem resides in the possibility that strong-interaction physics originates from massive gauge fields related to a system of conserved currents.[3] In this note, we shall show that in certain cases vector mesons do indeed acquire mass when the vacuum is degenerate with respect to a compact Lie group.

Theories with degenerate vacuum (broken symmetry) have been the subject of intensive study since their inception by Nambu.[4-6] A characteristic feature of such theories is the

those vector mesons which are coupled to currents that "rotate" the original vacuum are the ones which acquire mass [see Eq. (6)].

We shall then examine a particular model based on chirality invariance which may have a more fundamental significance. Here we begin with a chirality-invariant Lagrangian and introduce both vector and pseudovector gauge fields, thereby guaranteeing invariance under both local phase and local γ_5-phase transformations. In this model the gauge fields themselves may break the γ_5 invariance leading to a mass for the original Fermi field. We shall show in this case that the pseudovector field acquires mass.

In the last paragraph we sketch a simple argument which renders these results reasonable.

(https://cds.cern.ch/images/CERN-HOMEWEB-PHO-2022-071-2)

The 1964 Brout-Englert paper (Image: APS)

Four years later, Brout, Englert and Higgs added the final piece of the puzzle by showing that a mathematical block called the Goldstone theorem, which had beset initial applications of spontaneous symmetry breaking to particle physics by implying the existence of unobserved massless particles, does not apply to gauge theories such as QED. Unaware that others were on the trail, Higgs sent a short paper on the idea to *Physics Letters* in July 1964 where it was accepted by Jacques Prentki, the editor based at CERN. In a second paper sent one week later, Higgs demonstrated the mathematics – but it was rejected. Shocked, Higgs sent it to *Physical Review Letters*, and added crucial material, in particular : "it is worth noting that an essential feature of this type of theory is the prediction of incomplete multiplets of scalar and vector bosons" – a reference to the Higgs boson that was almost never published. In a further twist of fate, Higgs' second paper was received and accepted the same day (31 August 1964) that *Physical Review Letters* published Brout and Englert's similarly titled work. Today, the scalar field that switched on a fraction of a nanosecond after the Big Bang, giving the universe a non-zero "vacuum expectation value", is generally referred to as the BEH field, while the particle representing the quantum excitation of this field is popularly known as the Higgs boson.

In further Nobel-calibre feats, Steven Weinberg incorporated the BEH mechanism into electroweak theory developed also by Abdus Salam and Sheldon Glashow, which predicted the W and Z bosons, and Gerard ‘t Hooft and Martinus Veltman put the unified theory on solid mathematical foundations. The discovery of neutral currents in 1973 in Gargamelle at CERN and of the charm quark at SLAC in 1974 gave rise to the elecroweak Standard Model. Flushing out and measuring its bosons took three major projects at CERN spanning three decades – the SPS proton-antiproton collider, LEP and the LHC. In the mid-1970s, John Ellis, Mary Gaillard and Dimitri Nanopoulos described how the Higgs boson might reveal itself, and experimentalists accepted the challenge.

The discovery of the Higgs boson at the LHC in 2012 ended one journey, but opened another fascinating adventure. Understanding this unique particle will take every last drop of LHC data, in addition to that of a “Higgs factory” that may follow. Is it elementary or composite? Is it alone, or does it have siblings? And what are the roles of the mysterious BEH field in the beginning and the fate of the universe?

“We’ve scratched the surface,” said Peter Higgs in 2019. “But we have clearly much more to discover.”

Matthew Chalmers

The Swiss Federal Council holds an extramural session at CERN

The special session of Switzerland’s executive body was followed by an official visit by the President of the Confederation.

The special session was followed by an official visit of the President of Switzerland Ignazio Cassis (left), who met with CERN Director-General Fabiola Gianotti (right) (Image: CERN)

As an international organisation, CERN has been hosting diplomatic visits on a regular basis since its earliest days. However, the visit of the entire Federal Council (the Swiss Confederation’s executive body, made up of seven elected representatives) on Wednesday, 27 April was a first. The Council came to CERN for an extramural session, i.e. one that takes place beyond the walls of the Federal Palace in Bern, where it usually meets. This special governmental meeting was followed by an official visit by the President of the Confederation, Ignazio Cassis.

Although unprecedented for CERN, this extramural version of the Federal Council’s weekly meeting is an established practice in Switzerland: since 2010, the Council has been demonstrating its commitment to the country’s regions by holding such external meetings at least once a year. This year it’s the turn of the Canton of Geneva, and the President of the Confederation has declared innovation and diversity as the themes for the Council’s visit. CERN is delighted to have been selected by the Federal Council as the place in Geneva that embodies these two concepts.

> I am very pleased that the Federal Council is holding its 16th extramural session at CERN. If Geneva is Switzerland’s window on the world, CERN is our window on the infinitely small and the infinitely fast. Another way of exploring the universe and understanding how our world works.

Ignazio Cassis, President of the Swiss Confederation

During their visit, the federal councillors met Fabiola Gianotti and the members of her Directorate. The Director-General presented the Laboratory and spoke with them, as well as with the members of the State Council of the Republic and Canton of Geneva and the mayor of Meyrin, who joined the federal delegation at CERN after the Council’s meeting. The party then departed to continue the day’s programme with a meet-and-greet with the people of the canton.

Later in the day, the Director-General and the Directorate again welcomed Ignazio Cassis, President of the Confederation and head of the Federal Department of Foreign Affairs, accompanied by Viola Amherd, the federal councillor who heads the Federal Department of Defence, Civil Protection and Sport, and Viktor Rossi, Vice-Chancellor of the Confederation. The President was received at the Globe of Science and Innovation, where he had the opportunity to view the progress of the CERN Science Gateway construction works, and then visited the ATLAS experiment cavern and the LHC tunnel. Before leaving the site, the President signed the Visitors’ Book, bringing the eventful day to a close.

Thomas Hortala

Farewell to two CERN club giants

Freddy Streun, co-founder of the CERN Ski club, and Norman Eatough, founder of the CERN Croquet club, are retiring from their club activities after decades of tireless service

Freddy Streun (left) and Norman Eatough (right) (Image: CERN)

The multinational nature of CERN is such that, since the Organization's early days, members of our community have added their own national sports to the wide-ranging activities coordinated by the CERN clubs. Freddy Streun, the Swiss co-founder of the Ski club, and Norman Eatough, hailing from the United Kingdom and founder of the Croquet club, perfectly embody this facet of the CERN "melting pot". After decades of event planning, organising, sweat and, above all, good fun with colleagues, they are both retiring from their respective clubs.

At 95, you can still find Freddy Streun on the slopes – he was an active instructor until he was 93 years old! And while this long-time ski enthusiast is leaving the CERN Ski club, advancing years have nothing to do with it: he's just leaving the region. In 1963, he sat on the club's founding committee and became its President in 1965. Since then, he has helped to steer the club from various positions, including as Vice-President, as it grew in membership and scope over the decades, offering everything from outings to competitions and lessons. Freddy was instrumental in organising these events each winter, and his expertise and vivacity will be sorely missed.

In 40 years as Croquet club President, Norman Eatough has left a distinctively British mark on CERN. After founding the club in 1982 with a small band of fellow Britons, Norman oversaw its steady expansion and diversification. Under his leadership, the club contributed to the formation of the Swiss Croquet Association, which led to similar clubs being created in Sion and Zurich. Now, at 89, Norman has handed over the Presidency to David Underhill during a club meeting in which he was presented with a statuette depicting a croquet mallet and a plaque commemorating his 40 years in charge.

We wish Norman and Freddy long and happy retirements and hope to see them around at CERN!

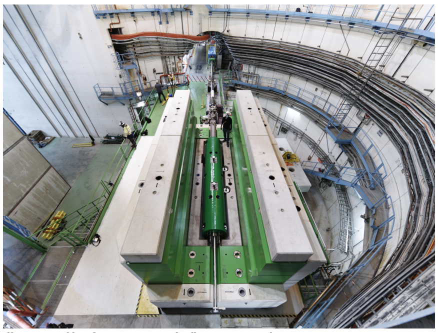
Thomas Hortala

The SPS beam dump

On 7 March, beams were circulated in the SPS for the first time this year. In this article, we reflect on the successful commissioning of the accelerator's new beam dump

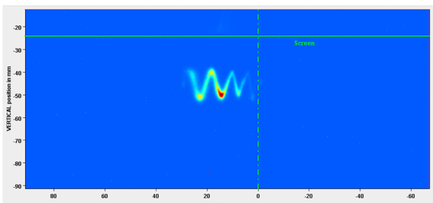
The new SPS beam dump, located at Point 5 of the accelerator, is equipped with several tonnes of steel, concrete and marble shielding. (Image: CERN)

As you may have read in a previous *Bulletin* article (https://home.cern/news/news/accelerators/ls2-report-new-sps-beam-dump-takes-shape), the SPS has a new beam dump, located at Point 5 of the accelerator. This new device, which is nine metres long and shielded with steel, concrete and marble, was built as part of the LHC Injectors Upgrade (LIU) project, in preparation for the High-Luminosity LHC (HL-LHC). "It was commissioned in April 2021, during the post-LS2 restart of the SPS. Everything went as planned," says the engineer in charge of the project, Antonio Perillo Marcone of the SY-STI-TCD section. "Thanks to the beam dump's new instruments – in particular, the new beam instrumentation monitoring system, which records the profile of the beam when it enters the dump – we can track the absorption of the particles in real time. In addition, new probes allow us to monitor the temperature inside the dump." As well as allowing real-time tracking, these new tools transmit data that is valuable for refining the digital models used to develop beam dumps in general, which are of increasing importance for CERN's future projects.



(https://cds.cern.ch/images/CERN-PHOTO-202010-134-28)

The new beam dump (green tube) was inserted into its shielded housing in October 2020. It was commissioned in April 2021, when the first post-LS2 beams were circulated in the SPS. (Image: CERN)



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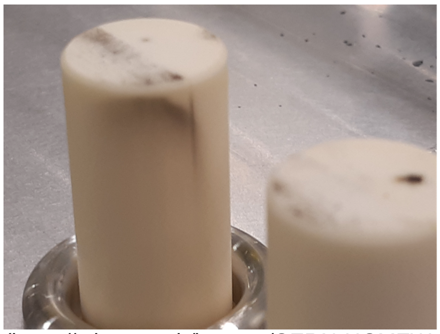
Impact of the beam on the beam dump as recorded by the new beam instrumentation monitoring system. (Image: CERN)

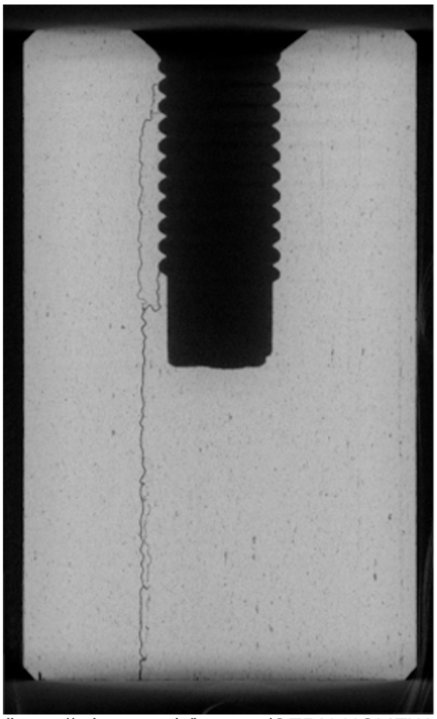
But before smashing into the beam dump, the particles circulating in the SPS must be deflected from their path by kicker magnets. "Six of these magnets have been installed in Long Straight Section 5 of the SPS, which leads to the beam dump. Five of them were already part of the SPS and a sixth has been added in preparation for the increased beam intensity of the future HL-LHC and the new configuration of the SPS beam dump system," says Étienne Carlier, project leader of the SPS beam dumping system upgrade project.

Unfortunately, while being commissioned in the accelerator, the new magnet revealed some unexpected limitations: "During tests in situ, the magnet was unable to withstand voltages above 35 kV, i.e. its maximum nominal operating voltage. This surprised us, because these same tests had been carried out up to 38 kV without any problems during the validation phase carried out on the surface, before installation," explains Étienne Carlier. By opening up and inspecting the spare magnet, which is identical in every respect, the experts were able to put their finger on the problem: "Small ceramic supports, called spacers, were found to be preventing the magnets from withstanding higher voltages," continues Étienne Carlier. We therefore replaced these parts in the spare magnet, which we then installed in the SPS to replace the defective magnet during the year-end technical stop (YETS)."



(https://cds.cern.ch/images/CERN-HOMEWEB-PHO-2022-068-2)

The defective spacers responsible for preventing the magnet from withstanding higher voltages were *removed from the spare magnet before it was installed in the SPS. (Image: CERN)*



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Tomography of a defective spacer showing internal cracking.(Image: CERN)

The spare magnet, which has been functioning at its nominal voltage since the restart with beam, was reconditioned in the machine during the technical stop, to ensure that it could handle voltages of up to 38 kV. It is currently being conditioned with beam as, being completely new, it releases a lot of particles – a normal process known as "outgassing". This phenomenon degrades the quality of the vacuum locally, although it does not impede the performance of the SPS.

Anaïs Schaeffer

Building work for CERN's new data centre in Prévessin begins

On Friday, 22 April, a ceremony was held to mark the beginning of construction of CERN's new energy-efficient data centre

Representatives of CERN and of the EQUANS France-Léon Grosse-Agapé consortium involved in the first-stone ceremony (Image: CERN)

On Friday, 22 April, a special ceremony was held to mark the beginning of construction of CERN's new data centre. The CERN Data Centre in Prévessin will come online during the final quarter of 2023. This new, energy-efficient facility will play a vital role in meeting the computing needs generated by the ambitious upgrade programme for the Large Hadron Collider (https://home.cern/science/accelerators/large-hadron-collider) (LHC).

When the High-Luminosity LHC (https://home.cern/science/accelerators/high-luminosity-lhc) (HL-LHC) comes online in 2029, the total computing capacity required by the experiments is expected to be ten times greater than today. Some of this shortfall will be filled by harnessing new, cutting-edge technologies and techniques: today, projects are examining how code can be modernised, how to capitalise fully on heterogeneous computing architectures, and how to benefit from the use of machine- and deep-learning approaches. Nevertheless, a significant increase in computing resources will be required.

"Computing is central to CERN's mission," says Charlotte Warakaulle, CERN Director for International Relations, who participated in the first-stone ceremony for the new data centre. "It turns data into knowledge, helping physicists unlock the secrets of the universe."

The CERN Data Centre in Prévessin will provide computing resources up to a total electrical power requirement of 12 megawatts. These resources will be delivered in three phases. Each phase corresponds to one of the three floors of the new data centre, with the first phase set to run from 2023 to 2025. It will see computing resources requiring up to 4 megawatts of electrical power installed; this is approximately the same as the power of the current CERN Data Centre in Meyrin for computing (excluding cooling).

The CERN Data Centre in Meyrin will continue to run in parallel, with a particular focus on data storage. Together, the two data centres will form the heart of the Worldwide LHC Computing Grid (WLCG), the global computing network used to analyse and store data from the LHC experiments. Today, the WLCG consists of 170 computer centres in 42 countries; it provides 1.4 million computer cores and 1.5 exabytes of storage.

Energy efficiency is at the core of the new data centre's design; CERN's Procurement Service paid special attention to including sustainable solutions for the new building. CERN aims for the new data centre to have a power usage effectiveness (PUE – an indicator used for measuring the energy efficiency of a data centre) of around 1.1. To put this in context, the global average PUE for large data centres is around 1.5, with new data centres typically achieving a PUE between 1.2 and 1.4 (the closer to 1.0, the better the PUE score). The PUE of the CERN Data Centre in Meyrin is about 1.5.

(https://cds.cern.ch/images/CERN-HOMEWEB-PHO-2022-067-1)

An artist's impression of the CERN Data Centre in Prévessin. The facility will consist of three floors, to be progressively filled with computing equipment over the first ten years of operation. (Credit: + IMGS – Rocco Valantines)

The CERN Data Centre in Prévessin will make use of the latest cooling technologies and will recuperate heat energy for warming other buildings on site. During the data centre's first phase of operation, the majority of the rejected heat will be recovered. Projects for using this are now under consideration, with the target of bringing them online during this first phase.

“We’re proud that our new data centre will achieve the highest levels of energy efficiency,” says Enrica Porcari, Head of the CERN IT department. “This helps us to keep costs down and fulfil our commitment to protecting the environment.”

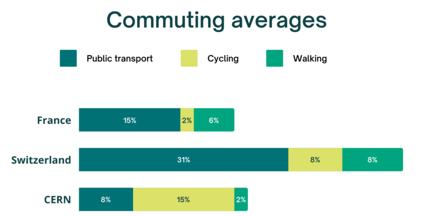
Enrica Porcari and Charlotte Warakaulle were joined at the first-stone ceremony by Pippa Wells CERN Deputy Director for Research and Computing, and Wayne Salter, leader of the project behind this new data centre. They were also joined by representatives of the companies that will be responsible for building the new data centre and operating it for the first ten years. Together, the group placed a time capsule into the building, containing a microprocessor, the signed contract for the new data centre and a photo of the members of the IT department in 2022.

Andrew Purcell

Environmental awareness: how CERN supports and encourages alternative forms of mobility

A step-by-step approach to environmentally responsible commuting and duty travel

A bike station at CERN - cycling makes up about 15% of all commutes to and from CERN (Image: CERN)



(https://cds.cern.ch/images/CERN-HOMEWEB-PHO-2022-064-1)

Commuting averages for soft mobility and public transport to and from CERN, compared to Switzerland and France. (Image: Mobilidée 2015, Swiss Federal Statistical Office 2019, INSEE 2017)

With a site spanning some 600 hectares across two Host States, commuting and intra- and inter-site mobility pose a real challenge for CERN. With road traffic accounting for 19% of Europe’s total greenhouse gas (GHG) emissions, reducing the use of road transportation in commuting and duty travel represents a clear lever for CERN to impact its indirect GHG emissions.

In 2015, a survey by the Canton of Geneva focusing on international organisations in the region revealed that 17% of CERN commutes were made by soft mobility (cycling and walking), which is higher than the French average and on a par with the Swiss average. This was confirmed by a mobility survey carried out at CERN in 2018 (https://home.cern/news/news/cern/getting-mobility-right-track). Around 70% of CERN personnel live in France and most commute by car owing in part to the lack of public transport.

CERN’s goal for 2025 (https://hse.cern/environment-report-2019-2020/emissions) is to keep individual motorised vehicle commuting constant. In close collaboration with the local authorities, CERN has implemented several initiatives to encourage soft mobility both to/from and at work. These include the shuttle service (https://sce-dep.web.cern.ch/cern-shuttle-service) and a fleet of bicycles (https://sce-dep.web.cern.ch/mobility/bike-rental) available free of charge to members of the personnel. In 2021, CERN launched a pilot scheme for free rental of e-bikes and e-scooters (https://sce-dep.web.cern.ch/mobility/bike-sharing-pilot) on its two main sites, and has also increased its cycling routes (https://home.cern/news/announcement/cern/creation-cycle-lanes-meyrin-and-prevessin-sites) (a map showing all the cycling routes around CERN can be found here).

A topic that comes up with increasing frequency concerns electric cars. As a move in this direction for CERN’s own vehicle fleet implies major investments in the infrastructure, the Organization is implementing a gradual approach by evaluating a reduction of the current professional car fleet and the possibility to use electric cars on site.

All mobility projects and new approaches are closely followed up and regularly reviewed by SCE (https://sce-dep.web.cern.ch/) in collaboration with other departments. Since 2016, a working group on mobility has been continually investigating practices at CERN and proposing ways to optimise its mobility infrastructure.

Duty travel is also the subject of a dedicated working group, with a view to updating the CERN-wide guidelines on the matter and considering how to empower and encourage CERN personnel to make climate-conscious decisions when planning such travel.

In addition, the Organization takes part in wider exchanges on mobility with the Canton of Geneva and other international organisations in the region.

Finally, CERN relies on collaboration with its Host States to optimise commuting to and between the sites. In this context, the Ain Department is currently evaluating a project with the aim of developing alternative modes of transport to individual cars and to simplify the routes for pedestrians and cyclists around the Porte de France near CERN’s Gate E (https://www.ain.fr/solutions/reamenagement-giratoire-porte-de-france/).

As we return to regular on-site work in COVID-19 Level 1 – Green, now is a good time for us all to reflect on our mobility habits and how we can effectively contribute to reducing GHG emissions in our own way. Car sharing, taking the bus or cycling, even just once a week, can make a significant difference. Biking to work is not only good for the environment: it has tangible health benefits too. And let us all remember to respect each other whatever our mode of transport, acting in a safe manner towards all road users, whether it be on foot, two wheels or four.

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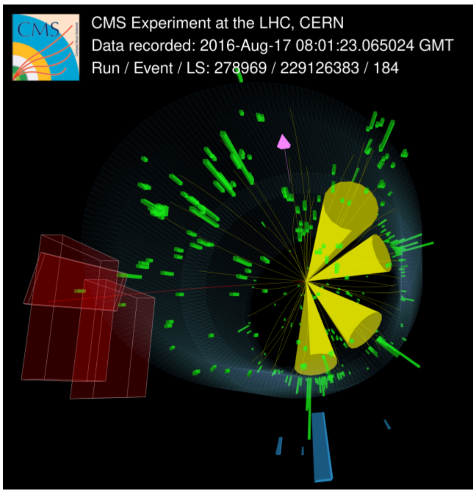
This article is part of the series “CERN’s Year of Environmental Awareness”.

CMS measures the mass of the top quark with unparalleled accuracy

Precise knowledge of the top-quark mass is of paramount importance to understand our world at the smallest scale



The classical signature of a top-quark pair produced in LHC collisions is four jets (yellow cones), one muon (red line, also detected by the CMS muon detectors as red boxes), and missing energy from a neutrino (pink arrow). (Image: CERN)

The CMS collaboration at the Large Hadron Collider (https://home.cern/science/accelerators/large-hadron-collider) (LHC) has performed the most accurate ever measurement of the mass of the top quark – the heaviest known elementary particle. The latest CMS result estimates the value of the top-quark mass with an accuracy of about 0.22%. The substantial gain in accuracy comes from new analysis methods and improved procedures to consistently and simultaneously treat different uncertainties in the measurement.

The precise knowledge of the top-quark mass is of paramount importance to understand our world at the smallest scale. Knowing this heaviest elementary particle as intimately as possible is crucial because it allows testing of the internal consistency of the mathematical description of all elementary particles, called the Standard Model (https://home.cern/science/physics/standard-model).

For example, if the masses of the W boson (https://home.cern/science/physics/w-boson-sunshine-and-stardust) and Higgs boson (https://home.cern/science/physics/higgs-boson) are known accurately, the top-quark mass can be predicted by the Standard Model. Likewise, using the top-quark and Higgs-boson masses, the W-boson mass can be predicted. Interestingly, despite much progress, the theoretical-physics definition of mass, which has to do with the effect of quantum-physics corrections, is still tough to pin down for the top quark.

And remarkably, our knowledge of the very stability of our universe depends on our combined knowledge of the Higgs-boson and top-quark masses. We only know that the universe is very close to a metastable state with the precision of the current measurements of the top-quark mass. If the top-quark mass was even slightly different, the universe would be less stable in the long term, potentially eventually disappearing in a violent event similar to the Big Bang.

To make their latest measurement of the top-quark mass, using data from proton–proton LHC collisions collected by the CMS detector in 2016, the CMS team measured five different properties of collision events in which a pair of top quarks is produced, instead of the up to three properties that were measured in previous analyses. These properties depend on the top-quark mass.

Furthermore, the team performed an extremely precise calibration of the CMS data and gained an in-depth understanding of the remaining experimental and theoretical uncertainties and their interdependencies. With this innovative method, all of these uncertainties were also extracted during the mathematical fit that determines the final value of the top-quark mass, and this meant that some of the uncertainties could be estimated much more accurately. The result, 171.77±0.38 GeV, is consistent with the previous measurements and the prediction from the Standard Model.

The CMS collaboration has made a significant leap forward with this new method to measure the top-quark mass. The cutting-edge statistical treatment of uncertainties and the use of more properties have vastly improved the measurement. Another big step is expected when the new approach is applied to the more extensive dataset recorded by the CMS detector in 2017 and 2018.

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Read more on the CMS website (https://cms.cern/news/cms-collaboration-measures-mass-top-quark-unparalleled-accuracy).

CMS collaboration

Brazil to become an Associate Member State of CERN

On 3 March 2022, CERN Director-General Fabiola Gianotti and Brazilian Minister for Science, Technology and Innovation Marcos Pontes signed an agreement admitting Brazil as an Associate Member State of CERN

CERN Director-General Fabiola Gianotti and Brazilian Minister for Science, Technology and Innovation Marcos Pontes (Image: CERN)

On 3 March 2022, CERN Director-General Fabiola Gianotti and Brazilian Minister for Science, Technology and Innovation Marcos Pontes signed an agreement admitting Brazil as an Associate Member State of CERN[1]. The Associate Membership will enter into force once Brazil has completed all necessary accession and ratification processes. Brazil will be the first country in Latin America to join CERN as an Associate Member State.

“We are very pleased to welcome Brazil as an Associate Member State. Over the past three decades, Brazilian scientists have contributed substantially to many CERN projects. This agreement enables Brazil and CERN to further strengthen our collaboration, opening up a broad range of new and mutually beneficial opportunities in fundamental research, technological developments and innovation, and education and training activities,” said Fabiola Gianotti, CERN Director-General.

“The accession of Brazil to CERN Associate Membership creates a robust framework for collaboration in research, technology development and innovation. The Brazilian scientific community has collaborated with CERN since its creation. Being an Associate Member State will foster novel opportunities for our scientists and engineers to participate in activities developed at CERN. Our industry will benefit as well through the participation in contract bids for both R&D and the supply of services and materials. I am certain that this partnership will take the Brazilian science, technology and innovation sector to a whole new level of development,” said Marcos Pontes, Brazilian Minister for Science, Technology and Innovation[1].

Formal cooperation between CERN and Brazil started in 1990 with the signature of an International Cooperation Agreement, allowing Brazilian researchers to participate in the DELPHI experiment at the Large Electron–Positron Collider (LEP). Today, Brazilian institutes participate in all the main experiments at the Large Hadron Collider (LHC): ALICE, ATLAS, CMS and LHCb. They are also involved in several other experiments and R&D programmes, such as ALPHA, ProtoDUNE at the Neutrino Platform, ISOLDE, Medipix and RD51. Brazilian nationals also participate very actively in CERN training and outreach programmes, including the Summer Student programme, the Portuguese-Language Teacher programme and the Beamline for Schools competition.

Over the past decade, Brazil's experimental particle-physics community has doubled in size. At the four main LHC experiments alone, more than 180 Brazilian scientists, engineers and students collaborate in fields ranging from hardware and data processing to physics analysis. Beyond particle physics, CERN and Brazil's National Centre for Research in Energy and Materials (CNPEM) have also been formally cooperating since December 2020 on accelerator technology R&D and its applications.

As an Associate Member State, Brazil will attend meetings of the CERN Council and the Finance Committee. Brazilian nationals will be eligible for limited-duration staff positions, fellowships and studentships. Brazilian companies will be able to bid for CERN contracts, increasing opportunities for industrial collaboration in advanced technologies.

[1]Marcos Pontes served as Brazilian Minister for Science, Technology and Innovation until 31 March 2022.

The President of Croatia visits CERN

President of Croatia Zoran Milanović with CERN Director-General Fabiola Gianotti on 7 April 2022 (Image: CERN)

The easing of health and safety restrictions has put protocol visits back on the agenda at CERN. The President of Croatia, an Associate Member State, honoured CERN with his presence on Thursday, 7 April. Zoran Milanović was welcomed at LHC Point 5 by the sub-prefect for Gex and Nantua, Pascaline Boulay, along with a CERN delegation that included the Director-General, Fabiola Gianotti, and several CERN Directors.

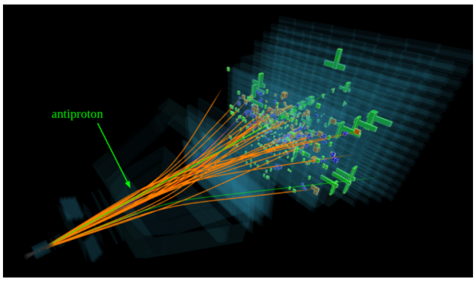
Accompanied by the spokesperson of the CMS experiment, Luca Malgeri, President Milanović took a dive into the world of CMS with a visit to the exhibition that tells the story of this large LHC experiment, before plunging, more literally this time, into the depths of the experiment area. During his visit of the CMS technical galleries and caverns, he was shown both the LHC tunnel and the majestic detector, before returning to the surface to round off the day's activities with a discussion with representatives of CERN's Croatian community.

This community has grown steadily in the several decades since collaboration between CERN and Croatia began. In the 1990s, when this collaboration was ramped up, Croatian scientists participated mainly in the SPS heavy-ion experiment programme and in the preparations for the ALICE experiment. The contributions of Croatian users became more diversified following the signature of the International Cooperation Agreement in 2001, and even more so when the country became an Associate Member State in 2019. Since then, around forty Croatian scientists have been involved in the ALICE and CMS experiments, as well as in non-LHC experiments, such as ISOLDE.

Thomas Hortala

LHCb reveals secret of antimatter creation in cosmic collisions

The finding may help determine whether or not any antimatter seen by experiments in space originates from dark matter



A proton–proton collision event recorded by the LHCb detector, showing the track followed by an antiproton formed in the collision (Image: CERN)

At the Quark Matter conference (https://indico.cern.ch/event/895086/) today and at the recent Rencontres de Moriond (https://moriond.in2p3.fr/2022/QCD/) conference, the LHCb collaboration presented an analysis (https://lhcb-outreach.web.cern.ch/2022/04/07/lhcb-measurements-help-to-understand-possible-signatures-of-dark-matter-presence-in-the-universe/) of particle collisions at the Large Hadron Collider (LHC) that may help determine whether or not any antimatter seen by experiments in space originates from the dark matter that holds galaxies such as the Milky Way together.

Space-based experiments such as the Alpha Magnetic Spectrometer (AMS), which was assembled at CERN and is installed on the International Space Station, have detected the fraction of antiprotons, the antimatter counterparts of protons, in high-energy particles called cosmic rays. These antiprotons could be created when dark-matter particles collide with each other, but they could also be formed in other instances, such as when protons collide with atomic nuclei in the interstellar medium, which is mainly made up of hydrogen and helium.

To find out whether or not any of these antiprotons originate from dark matter, physicists therefore have to estimate how often antiprotons are produced in collisions between protons and hydrogen as well as between protons and helium. While some measurements of the first have been made, and LHCb reported in 2017 (https://lhcb-outreach.web.cern.ch/2017/03/27/measurement-of-antiproton-production-in-p-he-collisions/) the first-ever measurement of the second, that LHCb measurement involved only prompt antiproton production – that is, antiprotons produced right at the place where the collisions took place.

In their new study, the LHCb team looked also for antiprotons produced at some distance from the collision point, through the transformation, or "decay", of particles called antihyperons into antiprotons. To make this new measurement and the previous one, the LHCb researchers, who usually use data from proton–proton collisions for their investigations, used instead data from proton–helium collisions obtained by injecting helium gas into the point where the two LHC proton beams would normally collide.

By analysing a sample of some 34 million proton–helium collisions and measuring the ratio of the production rate of antiprotons from antihyperon decays to that of prompt antiprotons, the LHCb researchers found that, at the collision energy scale of their measurement, the antiprotons produced via antihyperon decays contribute much more to the total antiproton production rate than the amount predicted by most models of antiproton production in proton–nucleus collisions.

“This result complements our previous measurement of prompt antiproton production, and it will improve the predictions of the models,” says LHCb spokesperson Chris Parkes. “This improvement may in turn help space-based experiments find evidence of dark matter.”

“Our technique of injecting gas into the LHCb collision point was originally conceived to measure the size of the proton beams,” says LHCb physics coordinator Niels Tuning. “It is really nice to see again that it also improves our knowledge of how often antimatter should be created in cosmic collisions between protons and atomic nuclei.”

Additional information

Video:

https://videos.cern.ch/record/2295741 (https://videos.cern.ch/record/2295741)

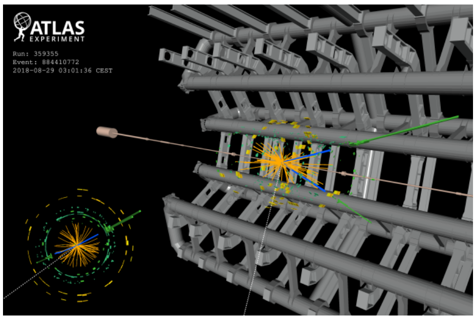
Pictures:

https://cds.cern.ch/record/2639202/files/201809-232_03.jpg?subformat=icon-1440 (https://cds.cern.ch/record/2639202/files/201809-232_03.jpg?subformat=icon-1440)

https://cds.cern.ch/record/2302374/files/201802-025_08.jpg?subformat=icon-1440 (https://cds.cern.ch/record/2302374/files/201802-025_08.jpg?subformat=icon-1440)

ATLAS strengthens its search for supersymmetry

The collaboration has tackled challenging supersymmetry scenarios, surpassing long-standing limits set by the LEP collider



Collision event studied in the ATLAS search for charginos and sleptons. It shows two electrons (blue), missing energy (dashed white line) and no particle jets. Energy deposits in the experiment’s liquid-argon calorimeter are shown in green, and those in the hadronic calorimeter are in yellow. (Image: CERN)

Where is all the new physics? In the decade since the Higgs boson’s discovery, there have been no statistically significant hints of new particles in data from the Large Hadron Collider (https://home.cern/science/accelerators/large-hadron-collider) (LHC). Could they be sneaking past the standard searches? At the recent Rencontres de Moriond conference (https://moriond.in2p3.fr/2022/), the ATLAS collaboration at the LHC presented several results of novel types of searches for particles predicted by supersymmetry.

Supersymmetry, or SUSY for short, is a promising theory that gives each elementary particle a “superpartner”, thus solving several problems in the current Standard Model (https://home.cern/science/physics/standard-model) of particle physics and even providing a possible candidate for dark matter (https://home.cern/science/physics/dark-matter). ATLAS’s new searches targeted charginos and neutralinos – the heavy superpartners of force-carrying particles in the Standard Model – and sleptons – the superpartners of Standard Model matter particles called leptons. If produced at the LHC, these particles would each transform, or “decay”, into Standard Model particles and the lightest neutralino, which does not further decay and is taken to be the dark-matter candidate.

ATLAS’s newest search (https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/CONFNOTES/ATLAS-CONF-2022-006/) for charginos and sleptons studied a particle-mass region previously unexplored (https://atlas.cern/updates/briefing/strong-constraints-supersymmetric-dark-matter) due to a challenging background of Standard Model processes that mimics the signals from the sought-after particles. The ATLAS researchers designed dedicated searches for each of these SUSY particle types, using all the data recorded from Run 2 of the LHC and looking at the particles’ decays into two charged leptons (electrons or muons) and “missing energy” attributed to neutralinos. They used new methods to extract the putative signals from the background, including machine-learning techniques and “data-driven” approaches.

These searches revealed no significant excess above the Standard Model background. They allowed the ATLAS teams to exclude SUSY particle masses, including slepton masses up to 180 GeV. This slepton mass limit surpasses limits (https://lepsusy.web.cern.ch/lepsusy/) at low mass that were set by experiments at the LHC’s predecessor – the Large Electron–Positron (https://home.cern/science/accelerators/large-electron-positron-collider) (LEP) collider – and that have stood for nearly twenty years. Moreover, it rules out some of the scenarios that could explain the long-standing anomaly associated with the magnetic moment of the muon, which has recently been corroborated by the Muon g-2 experiment (https://news.fnal.gov/2021/04/first-results-from-fermilabs-muon-g-2-experiment-strengthen-evidence-of-new-physics/) at Fermilab in the US.

ATLAS physicists have also released the results of a new search for chargino–neutralino pairs, following up on some previous small excesses (https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/SUSY-2017-03/) seen in early analyses of Run 2 data. They studied collision events where the chargino and neutralino decay via W (https://home.cern/science/physics/w-boson-sunshine-and-stardust) and Z (https://home.cern/science/physics/z-boson) bosons respectively, with the W boson decaying to “jets” of particles and the Z boson to a pair of leptons. When the mass difference between the produced neutralino and the lightest possible neutralino lies below the Z boson mass, it is harder to select the signal events and the backgrounds are more challenging to model. This is the first ATLAS result in this decay channel to target this difficult mass region. The search found no significant deviation from the Standard Model prediction and led to new bounds on SUSY particle masses.

With the LHC set to begin its third data-taking run, ATLAS physicists are looking forward to building on these exciting results to continue their SUSY searches, in particular by targeting SUSY models that are well motivated theoretically and offer solutions to existing tensions between measurements and Standard Model predictions.

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Read more on the ATLAS (https://atlas.cern/updates/briefing/strengthening-SUSY-searches) website.

ATLAS collaboration

Computer security

Computer Security: Log in. Click. Be secure

The ultimate silver bullet to protect your account, computer and data is using a sufficiently complex and unique password combined with a second-factor token

The ultimate silver bullet to protect your account, computer and data is using a sufficiently complex and unique password combined with a second-factor token, i.e. in addition to the password you know, something you have, like your smartphone or a hardware token. This authentication process is known as two-factor authentication ("2FA"). It presents a huge hurdle for any attacker, as they would need to not only acquire your password, which can be achieved virtually ("CERN has been phished again (https://home.cern/news/news/computing/computer-security-cern-has-been-phished-again)"), but also physically steal your hardware token. As announced in the *Bulletin* of November 2021 ("Multifactor for the masses (https://home.cern/news/news/computing/computer-security-multifactor-masses)"), CERN is ready to roll out 2FA for part of the CERN community in the second quarter of 2022. Log in. Click. Be secure.

In 2020, CERN focused on rolling out 2FA for experts needing to access and administer certain computing services, i.e. those with access to critical control systems (e.g. via the BE department's ROGs), IT systems (e.g. using Foreman) or sensitive data. However, this led to confusion among many users on when to use just their password and when to use multi-factor authentication. Also, this did not take full advantage of two-factor authentication, as thorough, coherent and profound 2FA deployment is seen as the silver bullet for achieving account security (as already employed by your bank and, possibly, used by you outside CERN).

Hence, as of the second quarter of 2022, using two-factor authentication when logging into any CERN web application will become mandatory for those aforementioned experts given their critical powers and the critical nature of their accounts. As of then, CERN's new web-based Single Sign-On (SSO) portal will require them to authenticate with both their password and their second factor for any website behind CERN's new web-based SSO*, regardless of whether it is to access a critical control system, administer a very important computing service or just browse the CERN phonebook or any other webpage behind the SSO.

Two hardware tokens are currently supported:

- a dedicated one-time password generation app for smartphones – making that smartphone the second hardware token – or
- a physical USB token (e.g. "Yubikey") that uses a CERN-dedicated private/public keypair (https://webauthn.guide/ (https://webauthn.guide/)) for the second authentication step.

Once authenticated correctly, work will continue as normal, as browser sessions will stay active for 12 hours (https://auth.docs.cern.ch/user-documentation/time-limits) or until the browser is closed, or another browser/device is used. This would give those experts, their accounts, their data and applications and – ultimately – CERN the best protection against identity theft and password exposure.

People who are using CERN computing facilities "only" for their research duties and scientific endeavours are not affected by this new feature deployment but are still invited to opt in through the IT User Portal (https://users-portal.web.cern.ch/), and we hope that as many people as possible value their protection highly enough to take this additional step – a step that is common when accessing your bank account, for instance.

Roll out of this "2FA-WithNewSSO" ("2FA-WINS") feature has started and will pursue in a staged approach commencing today for all volunteers interested in better securing and protecting their account and digital life (https://home.cern/news/news/computing/computer-security-protect-your-family). Just subscribe to this e-group (https://e-groups.cern.ch/e-groups/EgroupsSubscription.do?egroupName=2fa-always-on-volunteers-sso) to join. For members of the CERN IT department, the usage of 2FA-logins on CERN's new web-based SSO will become mandatory during Q2 2022, and, subsequently, followed by all experts holding critical access in the course of summer 2022. Check out all the details (like how to activate 2FA or what to do if you lose it) on our dedicated webpage (https://security.web.cern.ch/recommendations/en/2FA.shtml). Log in. Click. Be secure.

**Non-web-based applications, like SSH bastion hosts, will continue to require 2FA only on a case-by-case basis. Similarly, logins via the old SSO are not affected as this old service is supposed to be phased-out.*

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

Computer Security team

Official communications

Exchange rate for the tax declaration form of 2021 income: for the attention of members of the personnel and pensioners living in France

For the tax declaration form of 2021 income, the average annual exchange rate to be used is **EUR 0.95* for CHF 1**.

*Communicated by the French Tax Authorities.

HR department

Taxation in France

Memorandum concerning the internal tax annual certificate and individual annual statement for 2021 (for the 2022 declaration of 2021 income in France)

The Organization would like to remind members of the personnel that they must comply with the national legislation applicable to them (cf. Article S V 2.02 of the Staff Rules).

I - Internal tax annual certificate and individual annual statement for 2021

The internal tax annual certificate or the individual annual statement for 2021, issued by the Finance and Administrative Processes Department, is available since 8 February 2022 via HRT (under "My e-Documents and Self Services"). It is intended exclusively for the tax authorities.

1. If you are currently a member of the CERN personnel, you will have received an e-mail containing a link to your certificate or statement, which you can print if necessary.
2. If you are no longer a member of the CERN personnel or are unable to access your certificate or statement as indicated above, you will find information explaining how to obtain one on this page (https://admin-eguide.web.cern.ch/en/procedure/annual-certificates).

In case of difficulty in obtaining your certificate or statement, please send an e-mail explaining the problem to service-desk@cern.ch.

II - 2022 tax declaration form of 2021 income in France

The 2022 tax declaration form for 2021 income must be completed following the general indications available on this page (https://admin-eguide.web.cern.ch/en/procedure/income-tax-declaration-france).

If you have any specific questions, please contact your local "Service des impôts des particuliers" (SIP, Private Citizens' Tax Office) directly.

HR-Internal-tax@cern.ch

HR department

Announcements

Are you over sixty and living in France? Don't forget to book your second COVID-19 booster jab

As of April, the second COVID-19 booster jab is available in France for people aged between 60 and 79. For this age group, the vaccine must be administered at least six months after the previous booster. For those aged 80 and above, who have already been eligible for several months, this requirement is reduced to three months.

The second booster jab, i.e. the fourth dose in most cases, is recommended by the French government, but is not mandatory for your health pass to remain valid. The recommendation is based on studies – such as this one (https://www.nejm.org/doi/full/10.1056/NEJMoa2201570), which was conducted in Israel on subjects who had received the dose and was published in the *New England Journal of Medicine* – that have demonstrated the efficacy of the booster for the most vulnerable individuals. Although the efficacy drops by half in the fourth week following vaccination, the study shows that the antibodies produced as a result of the injection offer real added protection for people over sixty years of age, as well as those with comorbidities or immunodeficiency.

The booster jab can be administered in vaccination centres, pharmacies and medical practices in Ain, Haute-Savoie and all over France, as well as at home. However, it is not yet available in Switzerland, other than for immunocomprised individuals.

For residents of France, more information (in French) can be found on the French health insurance (https://www.ameli.fr/ain/assure/actualites/vaccination-contre-le-covid-19-extension-de-la-2e-dose-de-rappel-aux-personnes-de-60-79-ans) website and that of the government (https://www.gouvernement.fr/info-coronavirus).

FCC week 2022 from 30 May to 3 June – Register on Indico by 15 May

(https://cds.cern.ch/images/CERN-HOMEWEB-PHO-2022-069-1)

The 2022 Future Circular Collider (FCC) week will take place from 30 May to 3 June in Paris, France. The conference will be held in hybrid format, with the option to attend either in person or remotely.

The annual FCC collaboration meeting brings together the worldwide community working towards a world-leading high-energy physics facility for the twenty-first century. Parallel sessions will cover accelerator, detector and physics studies, progress on technological R&D, placement studies for the new research facility, and an assessment of its environmental and socioeconomic impact.

The meeting will be an opportunity to share findings, build new collaborations and solidify the vision for a post-LHC circular particle collider.

We are looking forward to a week of intense and lively exchanges on future circular colliders, both within and beyond our community.

Register on the event's Indico page by 15 May. (https://indico.cern.ch/event/1064327/)

New and improved first-aid training scheme launched at CERN

Take part in CERN's new comprehensive first-aid scheme, with two dedicated programmes to learn how to save lives and prevent occupational hazards

Training to become a workplace first-aider (SST). (Image: CERN)

Based on field experience and feedback from participants over the years, the HSE unit – represented by the Fire and Rescue Service, the Medical Service and the Safety Training Service – has designed a new and improved first-aid training scheme.

The new scheme comprises two complementary programmes: First Aid – Life-Saving Actions (https://lms.cern.ch/ekp/servlet/FORMAT1?CID=EKP000043535&LANGUAGE_TAG=en) and First Aid – Workplace First-Aider (SST*) (https://lms.cern.ch/ekp/servlet/ekp?CID=EKP000043803&TX=FORMAT1&BACKTOCATALOG=Y&DECORATEPAGE=N).


(https://cds.cern.ch/images/CERN-HSE-PHO-2016-005-1)

Learn how to use a defibrillator. (Image: CERN)

The First Aid – Life-Saving Actions programme covers basic first-aid techniques in just three hours. "The aim of this new, short and accessible programme, open to everyone working at CERN, is to teach as many people as possible what to do in the event of a medical emergency," explains Julie Biringer, a CERN safety training expert. "The programme covers the most commonly encountered and most critical emergencies, teaching participants how to use a defibrillator, perform CPR and treat injuries, wounds and haemorrhages, as well as how to tackle unconsciousness and airway obstruction. Participants also learn how to raise the alarm and summon life support in the most efficient way."

The First Aid – SST programme spans two days and its completion leads to the award of a certificate. This particular programme is reserved for members of the personnel put forward by the departments and experiments according to their strategic emergency response requirements and the specific risks at play. In addition to training people to perform first aid in the event of workplace accidents, this programme will also focus on prevention, i.e. reducing occupational risks.

The two programmes were rolled out in September 2021 and March 2022, respectively, and the number of available places will gradually increase in the coming months, with the goal of ultimately training several hundred people each year.

Take part by signing up now for the new First Aid – Life-Saving Actions programme or contact your supervisor, DSO (departmental safety officer) or LEXGLIMOS (Large Experiment Group Leader in Matters of Safety) to check if you are eligible for the First Aid – SST programme.

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**SST: sauveteur secouriste du travail / workplace first-aider*

HSE unit

13 May - CERN Alumni Virtual Company Showroom with Dotphoton

Join representatives from Dotphoton to find out more about the company, potential job opportunities and the skills and talents they are now seeking.

The event will start **at 11:00 CET on 13 May** with a general presentation and will be followed by a Q&A session, so come armed with your questions.

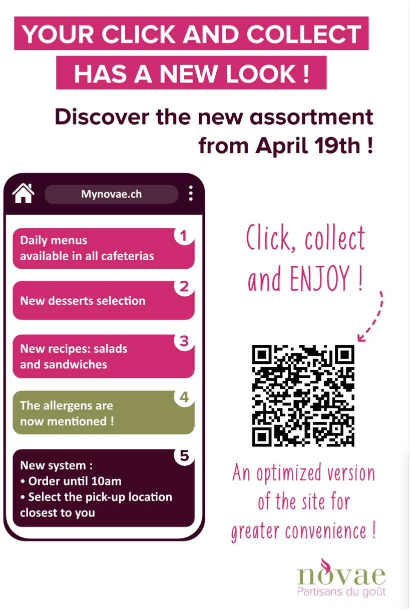
Please register here (https://alumni.cern/events/82723) for the event to receive the zoom link.

About Dotphoton

Dotphoton is an image compression solution for professional applications: it makes RAW images up to 10 times smaller while preserving quality, enabling the next generation of high-quality imaging solutions in photography, AI, biomedical and aerospace.

More information on the Alumni website (https://alumni.cern/events/82723).

New Novae Click & Collect



(https://cds.cern.ch/images/CERN-HOMEWEB-PHO-2022-065-2)

A new version of CERN restaurants' Click & Collect service has been available since 19 April. The improved system has been made possible by a partnership between the Campus Service and Novae with the aim to provide a more flexible service to its users.

The new page, accessible here (https://www.mynovae.ch/en/restaurant/391-click-collect-cern/salespoints/?code=CER103) or through a QR code, displays the day's menus in all cafeterias, as well as new desserts, salads and sandwiches (allergens and vegan options are now highlighted in the menus).

Furthermore, please note that the time from which you can choose and order your meal of preference has been pushed forward to 10 a.m., with a wide selection of pick-up locations available across the sites.

Obligation to register vehicles driven on the CERN site

With on-site work having resumed, and the holiday season approaching, we would like to remind you of a few key rules.

In accordance with Operational Circular No. 2, all drivers must facilitate the identification of their vehicle when on the CERN site.

You must therefore register all vehicles registered to you, including motorbikes:

- either online, using the vehicle registration application (https://vehicles.cern.ch/vehicles/),
- or in person by going to the Registration Service (55/1-001), open from Monday to Friday between 7.00 a.m. and 5.00 p.m., with a copy of your vehicle's registration document (*carte grise*).

We also remind you that parking on site is limited to five consecutive days and that the vehicle must have a number plate and be insured.

For periods longer than five days, long-term parking is available for vehicles (https://cern.service-now.com/service-portal/?id=sc_cat_item&name=long-term-parking-permit&se=guards) and bicycles (https://cern.service-now.com/service-portal/?id=sc_cat_item&name=bike-long-term-parking-permit&fe=entrance-control-guards) on request.

Issue with defibrillators: call 74444 in case of emergency

CERN has been advised by the manufacturer of the defibrillators installed on site that some of the devices' electrodes may be defective. As a result, some defibrillators may not be fully efficient but their use is not dangerous and still recommended in case of cardiac arrest.

The CERN Fire and Rescue Service has ordered new electrodes to replace deficient ones if necessary.

Stickers have also been put on the defibrillators reminding users to call 744 44 prior to using the device and to follow instructions received from the Safety Control Room operator.

To acquire basic first aid techniques in just three hours, you can enrol in CERN's First Aid – Life-Saving Action (https://lms.cern.ch/ekp/servlet/FORMAT1?CID=EKP000043535&LANGUAGE_TAG=en) programme.

Bike to Work 2022: time to hop back on!

Make the most of the spring weather and cycle to CERN

The 2019 edition of the "Bike to Work" competition (Image: CERN)

Bike to Work, the Swiss-wide cycling campaign, is back for its 2022 edition. The campaign encourages workers in companies all over Switzerland to commute by bike as often as possible.

To participate, you first need to find three colleagues to form a team of four. You can then register your team on the Bike to Work website (https://www.biketowork.ch/en/participation/Team_anmelden) or request to join an incomplete team.

There are no registration fees and no minimum distance requirement, and part of your journey can be undertaken by public transport. Non-cyclists are not left out: one team member is permitted to commute on foot, by skateboard or by any other means of non-motorised transport.

You can find detailed information on this event, as well as on "Bike to CERN", the Organization's own, year-round initiative, on the Bike to Work (https://www.biketowork.ch/) and Bike to CERN (https://espace.cern.ch/bike2CERN/Pages/default.aspx) web pages.

Safety first! Don't forget to consult the safety rules for cycling (https://espace.cern.ch/bike2CERN/Pages/tips_safety.aspx) and to complete the online course Road Traffic – Bike Riding (https://lms.cern.ch/ekp/servlet/ekp?PX=N&TEACHREVIEW=N&PTX=&CID=EKP000040487&TX=FORMAT1&LANGUAGE_TAG=en&DECORATEPAGE=N) before hopping on your bike.

Happy pedalling!

Ombud's corner

2021 Annual Report by the Ombud – let's talk!

The 11th Annual Report by the Ombud is now available on CDS at this address (https://cds.cern.ch/record/2806615/files/11th%20Annual%20report%20of%20the%20CERN%20Ombud.pdf) and will soon be published on the Ombud's website, where you can also find all of my predecessors' reports since 2011. I hope you enjoy reading it.

The annual report, which has been revamped this year, with more graphics and a new structure that makes it easier to find the sections that you're interested in, is a key part of the Ombud's mandate (https://ombuds.web.cern.ch/sites/default/files/reports/CERN%20Ombudsman's%20mandate.pdf):

"The Ombud shall issue an annual report on his/her activities to the Director-General. This report shall contain anonymous, statistical information with respect to matters brought to his/her attention, including their nature and status or outcome, as well as a general assessment of the operation of the Office of the Ombud."

First and foremost, it's a tool that **ensures transparency and facilitates communication** with the CERN community that the Ombud serves. Among the wealth of information it contains, you'll find the **demographics** of visitors to the Ombud's office and **a statistical analysis** of the problems discussed, in strict compliance with the confidentiality requirements. Did you know, for example, that we see two peaks in the age distribution of my visitors? I'm most frequently consulted by people in the 25–30 and 50–60 age ranges, who come to discuss the professional problems that are specific to these age groups.

The report is also a chance for the Ombud to set out some **observations and conclusions** inspired by a year of active listening, analysis of situations and informal conflict resolution.

Finally, the Ombud, whose job it is to observe and to identify patterns, proposes **pragmatic, simple actions** aimed at helping to resolve the most acute and most frequently raised problems, as well as those that appear to be systemic.

The Ombud's proposals are, of course, submitted to the Director-General and the Enlarged Directorate, who may, if they wish, take them up or use them for inspiration. In addition, each and every one of you can, individually, reflect on those observations and proposals that are particularly relevant to your working environment.

You may have questions about my report, or wish to discuss some of my observations or the actions I've proposed. This is why I invite you, if you wish, to join me on Zoom for **an informal exchange of views at 11.00 a.m. on Tuesday, 3 May**. Click here to join the meeting: https://cern.zoom.us/j/65139335592?pwd=THdVV0xra3NXN1Q1THJUeWpPaG5hUT09 (https://cern.zoom.us/j/65139335592?pwd=THdVV0xra3NXN1Q1THJUeWpPaG5hUT09)

The Ombud's 2021 Annual Report will tell you all you've ever wanted to know about the role of the Ombud and the services I offer. I invite you to read it (https://cds.cern.ch/record/2806615/files/11th%20Annual%20report%20of%20the%20CERN%20Ombud.pdf)and to join me (https://cern.zoom.us/j/65139335592?pwd=THdVV0xra3NXN1Q1THJUeWpPaG5hUT09)on Zoom at 11.00 a.m. on 3 May, if you

wish, to ask all your questions and discuss the report.

Laure Esteveny

I want to hear from you – feel free to email ombud@cern.ch with any feedback or suggestions for topics you'd like me to address. NB: If you would like to be notified about posts, news and other communications from the CERN Ombud, please register to receive the CERN Ombud news (https://e-groups.cern.ch/e-groups/EgroupsSubscription.do?egroupName=cern-ombud-news).