

## ADRENALINE RUSH AT LHC POINT 5

CERN's most ambitious emergency response exercise to date took place on 13 November at LHC Point 5, with the involvement of French, Swiss and CERNois safety and rescue teams



French fire rescue trucks at CMS for the emergency response exercise (Image: CERN)

It is a peaceful Saturday morning in Cessy, France. Thick autumn clouds conceal the slopes of the Jura and, close to the sleepy village, the CMS experiment at the LHC gets ready for the coming accelerator run. But deep within the vast experiment complex, an incident interrupts the quiet: a careless technician, bypassing every safety system, mishandles gas, which catches fire. From this point on, all hell breaks loose. The gas spreading to the underground cavern explodes, injuring workers and visitors and causing scaffolding to collapse on one of the underground evacuation paths. Fried by the subsequent power surge, a crane engine crashes, immobilising the machine and its

operator, stuck dozens of metres above ground. The nearby High-Luminosity LHC (HL-LHC) worksite and caverns are not spared: kindled by the power surge, fire engulfs a break room and, further down the site, a mechanic gets trapped under heavy metal beams. Oh, and an electrician gets shocked and injured while trying to solve a technical problem in a surface building, too.

Sound plausible?

"To play an exercise of this scale, we needed to come up with likely scenarios after a very, very unlikely trigger."

(Continued on page 2)

### A WORD FROM CHRISTOPHER HARTLEY

**INDUSTRY AND RESEARCH – JOINING FORCES TO ACCELERATE PROGRESS AND INNOVATION**

CERN's industrial suppliers are crucial to advancing its scientific mission. It is through successful collaborations with businesses across a variety of industries that advancements in accelerators, detectors, computing and many other areas become realities.

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# A WORD FROM CHRISTOPHER HARTLEY

## INDUSTRY AND RESEARCH – JOINING FORCES TO ACCELERATE PROGRESS AND INNOVATION

It is often stated that CERN is a city within a city, and this requires efficient services of all types from a myriad of suppliers in order to function. Moreover, it is its extraordinary engineering works that enable CERN to be at the pinnacle of fundamental science and thus deliver impact through innovation.

Procurement of supplies and services is thus central to CERN's operation and advancement. Furthermore, it remains a fundamental aspect of CERN's economic impact across its Member and Associate Member States. There are many laudable reasons why a given country may be motivated to be part of the CERN family, but it is clear that industrial return is a key motivator in many Member States due to its economic impact, as CERN spends nearly half of its annual budget on procurement over a wide range of goods and services.

Procurement provides not only direct financial returns, but also an opportunity to grow and learn. Indeed, CERN's Procurement group is in charge of building, developing and maintaining relations with industry and hence creating conditions for technological watch within the Member States. This mutually beneficial relationship is fostered by CERN's knowledge transfer activities, thanks to which firms can utilise CERN know-how and technologies for their own innovation.

In order to promote their national industries, Member States have traditionally organised targeted events called Industrial Days@CERN. Not only are these events vital in matching industry capabilities, know-how and innovation with CERN projects and needs, but they are also essential elements for a balanced industrial return across the Member States. During the pandemic, many of these events have taken place virtually, though we do hope that on-site

events may again be possible in the future.

The organisation of these events is a demonstration of our dedication to the interests of our Member States and requires commitment from all members of the CERN personnel, from the top management to the technical experts. It is also an opportunity for us to challenge our pre-conceptions about industry in the Member States, which is important to diversify our pool of suppliers and balance returns.

Going forward, I hope to see us hold more and more focused events, related to a given theme or to a specific event, drawing industry from across the Member States. This should also focus the events for CERN experts, since the objective of such events is to develop contacts and match companies with the relevant CERN technical counterparts and procurement officers, in order to address the upcoming challenges and requirements at CERN.

*Christopher Hartley*

*Christopher Hartley is the Head of the Industry, Procurement and Knowledge Transfer department*

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## ADRENALINE RUSH AT LHC POINT 5

We are already well prepared for the bad, but what of the worst of the worst?, explains Roberto Perruzza, LEXGLIMOS (group leader in matters of safety) at CMS who, along with Marc Nas, deputy group leader of the CERN Fire and Rescue Service, designed and controlled this large-scale, realistic emergency response exercise.

The complexity of the exercise's scenario, outlined above, was mirrored by the number and variety of teams involved. Supported by 90 CERN volunteers, who helped with coordination and safety and played the role of technicians, visitors and casualties, the main stars of the morn-

ing were seven safety and rescue teams hailing from one international organisation (the CERN Fire and Rescue Service) and two countries (the French and Swiss fire brigades and civil protection forces, plus the *Brigade Sanitaire Cantonale* and the Swiss *Samaritains* rescue association). The exercise was designed following the success of a similar exercise at the Globe in 2019, to enhance interoperability and communication between the teams and to improve knowledge and understanding of their respective working methods when implementing a multinational response to a major incident in a complex infrastructure at CERN.

For almost four hours, the 260 participants wreaked a perfectly orchestrated and executed havoc at Point 5, on the surface and in the CMS and HL-LHC caverns. The rescue teams had to deal with a very fake fire made of posters depicting flames, very real scaffolding set up in the CMS service cavern to impede the response, and casualties screaming in skilfully feigned pain. This allowed them to test the efficiency of the *doctrine équipes mixtes*, a common multinational response plan that anticipates interventions of a country's rescue teams on the other country's territory, as well as handover of command between teams in times of need – all of this under the framework of the tripartite agreement binding

CERN, France and Switzerland for matters of emergency response.

“We will identify and work on the lessons to be learned from the exercise in the coming weeks. But the main takeaway was clear from the minute we were done: we need to do it again, and more frequently, on a smaller scale! The relationships we build during these exercises will be crucial in the event of a real emergency response, as is the knowledge of the other teams' methods we gain in the process,” says Marc Nas. “Besides, it is a pleasure to work alongside people who are determined to power through a complex project and eager to make a success out of it. All the participants were very satisfied with the outcome and we look forward to repeating the exercise in the future.”



Mauro Poggia, the canton of Geneva's State councillor in charge of security, population and health, and Pascaline Boulay, Sous-Préfète of Gex and Nantua in France, attended as spectators in the company of Charlotte Warakaulle, CERN's Director for International Relations (background). Marc Nas (foreground, left) and Roberto Perruzza (foreground, right) performed exercise control. (Image: CERN)



Clockwise from top left:  
- Volunteering “casualties” are rescued in the CMS cavern  
- Swiss firefighters intervene at HL-LHC point 5 to save a crane operator  
- Commanders of the various response teams discuss their course of action  
- Swiss Samaritains tend to volunteering “casualties” in a tent outside CMS;  
all as part of the emergency response exercise. (Image: CERN)

Thomas Hortalá

## GIVE THE GIFT OF SECURITY TO COMMUNITIES AT RISK OF NATURAL DISASTERS ALL OVER THE WORLD



(Image: 2019 Zapylaieva Hanna/Shutterstock)

Powerful and unexpected natural events such as earthquakes and tsunamis can erase entire communities in seconds. In a world plagued by inequality, regions at risk are not always the best prepared to protect their populations from disaster.

To help them face such calamities, CERN is developing the Compact Precision Laser

Inclinometer (CPLI), an extremely sophisticated early-warning system for seismic events that will completely change civil protection strategies to protect communities and reduce direct losses.

A gift to the CERN & Society Foundation in this festive season is a gesture that could save a life from the destruction of earthquakes. You can donate now on the Foundation's website (<https://cernandsocietyfoundation.cern/save-life-cpli>).

Further development of the CPLI technology is currently limited by a lack of funds. With external support from donors, the CPLI technology will:

- be improved in terms of reliability and availability, allowing wider deployment, at a reasonable cost, in remote and underde-

veloped areas; CERN is committed to making the technology available worldwide to help all communities in need;

- be paired with increased processing power and software, which will allow online measurements and data processing with artificial intelligence techniques, a vital tool for early-alert systems.

*The Compact Precision Laser Inclinometer is the first technology selected under the CERN Technology Impact Fund, a new framework to support CERN technologies with strong potential to address existing global societal issues as identified by the United Nations Sustainable Development Goals (UN SDGs).*



# NEW BUILDING FOR THE PRÉVESSIN SITE

**The new Building 937 in Préveessin, inaugurated on 10 November, becomes an additional centre of the BE-CEM group's activities**



*The CRANEbot in the new robotics lab facility in building 937 (Image: CERN)*

The quiet revolution unfolding at CERN's Préveessin site is paving the way for infrastructure, environmental and public engagement projects for various departments. Among them is the Beams department (BE), whose new building is bringing all the activities of the Controls, Electronics and Mechatronics (BE-CEM) group onto the same site.

Two sections of the BE-CEM group – the Mechatronics, Robotics and Operation (CEM-MRO) and Electronics Production and Radiation Tolerance (CEM-EPR) sections – are of particular interest. Building 937 (B937), inaugurated on 10 November, brings under the same roof the lab facilities for robotics, mechatronics and electronics testing, cable manufacturing and radiation testing, along with offices for the two sections. The building's open-plan layout facilitates the work and discussions of both staff members and students.

B937 brings added operational value for the long-term activities of BE-CEM, notably by providing the MRO section with a proper infrastructure for robotics manufacturing, testing, accessibility and transport in the field. "What is important from an operational point of view is the entry

and exit of robots in an easy way through the dedicated entrance in the lab," explains Mario Di Castro, MRO section leader. "This was not possible in the previous laboratory, where there were accessibility constraints that could reduce the intervention time in the event of emergencies."

The BE-CEM group provides all CERN accelerators and experimental areas with robots ranging from off-the-shelf robots to large robots on wheels, such as the CERNbot robotic arm and TIM. Preparations of new robotic missions in the context of the High-Luminosity LHC (HL-LHC) project, such as the installation of vacuum assembly for experimental area (VAX) modules near high-radiation experimental areas at CMS and ATLAS, the robotic machining of the ATLAS shielding and the remote maintenance of LHC collimators, will take place in the new building.

B937 is located close to Building 927, which hosts an LHC mock-up that is used for robotics activities, making for better synergy between the conception, testing and training of robots.

The new building is of great value not just for the robotics lab, but also for the other facilities of the CEM-MRO and CEM-EPR sections. The BE-CEM group also provides "controls hardware and low level software design, controls infrastructure support and mechatronics for the LHC collimators and beam intercepting devices in the accelerator complex, the transfer lines and the experimental areas; and supports all CERN groups and sectors with electronics production and radiation tolerance testing as well as providing turnkey test and measurement solutions," emphasises Alessandro Masi, BE-CEM group leader. With all five sections of the BE-CEM group

now in Préveessin (B937, B864 and B774), collaborations and workflow will be facilitated within the group, but also within and with other departments.

The B937 project, which included an in-depth strategic review of functional user requirements, was executed swiftly thanks to the close collaboration between the Site and Civil Engineering (SCE) department, project leader Luigi Serio and an external contractor that took on full responsibility for the fulfilment of the project's requirements.

B937 was designed according to the latest construction standards. It is compact in order to increase its overall efficiency and achieve a low energy consumption through features such as a circulating air unit to limit the use of air conditioning and luminosity detectors to prevent the use of unnecessary artificial lighting. "For projects similar to this one, where requirements can be established upfront, where you prepare a project management framework or methodology and you follow it correctly, it is the most effective, efficient and economical way to implement the infrastructure," declares the project leader for the building's construction, Luigi Serio.

By looking at the full life cycle of similar initiatives, from construction to operation, maintenance and long-term impact on the Organization's activities, a return of experience can guide future decisions on infrastructure projects at CERN.

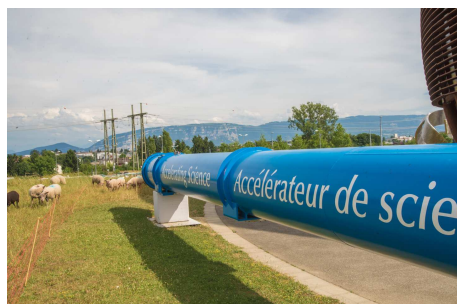
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*This article is a part of the series "A quiet revolution is under way at Préveessin".*

*Cristina Coman*

## CERN PUBLISHES ITS SECOND PUBLIC ENVIRONMENT REPORT

**The document details the current status of CERN's environmental footprint, along with objectives for the coming years**



A herd of sheep next to the Globe and the ATLAS experiment (Image: CERN)

On 24 November, CERN published its second public environment report, covering the years 2019 and 2020. In 2019, CERN made a commitment to communicate on its environmental footprint every two years in order to ensure transparency and demonstrate its leadership in environmental management for research organisations. Like the first report, which covered the years 2017 and 2018, the second environment report has been prepared following the sustainability reporting standards laid out by the Global Reporting Initiative (GRI).

The period covered by the second report encompasses two years of CERN's accelerator complex shutdown. Consequently, the level of many environmental indica-

tors decreased significantly with respect to the previous reporting cycle. As an example, CERN's electricity consumption in 2019 and 2020 was about 64% lower than when the machines were running.

Beyond presenting the current status of CERN's environmental footprint, the report sets out the objectives for the coming years. "The production of CERN's first public environment report in 2020 enabled us to establish reporting frameworks and set concrete goals. This second report is about turning words into action," declares CERN's Director-General, Fabiola Gianotti.

As an example, the Laboratory is committed to reducing its direct (scope 1) greenhouse gas emissions by 28% by the end of 2024. In an effort to reach this goal, CERN has launched a leak repair campaign to decrease emissions from fluorinated gases in the large experiments. In addition, this report innovates by presenting data on its indirect (scope 3) emissions for the first time, which includes emissions related to business travel, personnel commutes, catering, waste management and water purification. This marks an important step in understanding and controlling the environmental impacts beyond CERN's

walls and upstream and downstream of the Organization's supply chain.

The environmental impact of the HL-LHC is also discussed in the report. In the long term, the new collider will enjoy better performances and a higher data per unit of energy used ratio – for which a metric has been developed and is presented in the report. With respect to Run 1, the HL-LHC will increase the energy efficiency of CERN's flagship facility by a factor of ten over 20 years.

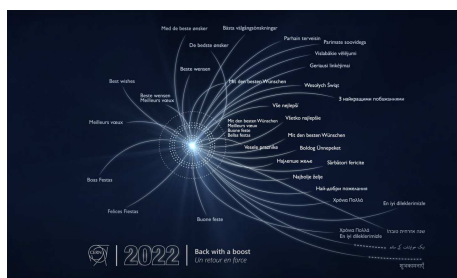
Join the discussion on CERN and the environment in the dedicated Mattermost channel (<https://mattermost.web.cern.ch/hse-unit/channels/environment-cern>).

*Links to the Environment Report in English:*  
*[hse.cern/environment-report-2019-2020](https://hse.cern/environment-report-2019-2020)*  
*and French:* *[hse.cern/fr/rapport-environnement-2019-2020](https://hse.cern/fr/rapport-environnement-2019-2020)*

Link to download PDF: [https://e-publishing.cern.ch/index.php/CERN\\_Environment\\_Report/issue/archive](https://e-publishing.cern.ch/index.php/CERN_Environment_Report/issue/archive)

HSE unit

## SEND A CERN E-CARD



(Image: CERN)

Send colleagues, family and friends holiday greetings using the CERN e-card service.

The video (<https://www.youtube.com/watch?v=r55KLQmPqfo>) is available on YouTube.

You can create your own personalised electronic cards by signing in with your

CERN account on this site (<https://ecard.web.cern.ch/>). Please note that this year's cards will only be available virtually and that no physical copies will be distributed.

# RELIVE THE 50TH ANNIVERSARY OF HADRON COLLIDERS @ CERN



(Image: CERN)

Last month, CERN celebrated 50 years since the first collisions in the world's first hadron collider, the Intersecting Storage Rings (ISR). The Symposium welcomed a panel of world-class speakers that reviewed the rich history and achievements of hadron collider research.

In the recording below, CERN's Director-General Fabiola Gianotti takes us through the future plans for the High-Luminosity LHC and beyond.

The video ([https://www.youtube.com/watch?v=vrE2QUEe0ZM&list=PL6583\\_bOAHxabD\\_Sbh8xhDMFbkP13E2ZN&index=13](https://www.youtube.com/watch?v=vrE2QUEe0ZM&list=PL6583_bOAHxabD_Sbh8xhDMFbkP13E2ZN&index=13)) is available on YouTube.

We also invite you to watch or re-watch the discussions and presentations of the event on the Symposium's dedicated YouTube CERN Lectures playlist ([https://www.youtube.com/playlist?list=PL6583\\_bOAHxabD\\_Sbh8xhDMFbkP13E2ZN](https://www.youtube.com/playlist?list=PL6583_bOAHxabD_Sbh8xhDMFbkP13E2ZN)).

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## IEEE HONOURS AMALIA BALLARINO WITH JAMES WONG AWARD AT THE INTERNATIONAL CONFERENCE ON MAGNET TECHNOLOGY

**Amalia Ballarino, Deputy Leader of the Magnets, Superconductors and Cryostats group in the Technology department, has piloted the development of superconductors and innovative superconducting systems**



Amalia Ballarino (Image: CERN)

The 27th International Conference on Magnet Technology, which took place in Fukuoka, Japan, from 15 to 19 November, gave the superconductivity community at CERN reason to celebrate. Amalia Ballarino, who has for decades led CERN's efforts to develop superconductors and novel devices based on their use for the Organization's accelerators, was awarded the James Wong Award for Continuing and Significant Contributions to Applied Superconductor Materials Technology from the Institute of Electrical and Electronics Engineers (IEEE). The announcement of the prize came in July this year and the ceremony took place on 18 November.

The IEEE stressed Ballarino's role in the successful R&D programmes that led to

establishing a winning role for magnesium diboride ( $\text{MgB}_2$ ) and high-temperature superconductors (HTS) in accelerator applications. This success has led to the worldwide acceptance of high-temperature and  $\text{MgB}_2$  superconductors and heralded the development and use of  $\text{MgB}_2$  in transmission systems suitable for very high currents. The IEEE further highlighted her commitment to building bridges between research and industry, showcased by her involvement in the development and production of these innovative systems at an industrial scale, and her R&D activity on superconductors (niobium–titanium, niobium–tin,  $\text{MgB}_2$  and HTS) for future particle accelerators.

After joining CERN as a PhD student in 1995, Ballarino worked on the reliable application of HTS in current leads, an innovation at the time. Later in her career, she was responsible for the several thousand current leads that power the superconducting magnets of the LHC. Following work on the commissioning of the LHC, Ballarino and her team delved into the development of  $\text{MgB}_2$ -based transfer systems for the High-Luminosity LHC (HL-LHC), eventually making headlines in 2020 for operating the transmission of a whopping 110 kA (55 kA in each direction) over a 60-metre

transmission link. This work was undertaken in parallel with that of developing and purchasing the advanced low- and high-temperature superconductors required for the HL-LHC magnets.

The development of  $\text{MgB}_2$  for practical applications and the ingenious use of cabled wire in a transmission system made the technological prowess of the superconducting link possible.  $\text{MgB}_2$ , which was only recently discovered, transmits high current at up to 31 kelvin ( $-242^\circ\text{C}$ ), a higher temperature than conventional low-temperature superconductors, which sharply reduces operation costs and makes the technology susceptible to spread beyond particle accelerators. Links like these, which can transfer vast amounts of current within a small volume, could for example be used to deliver electricity in big cities or to connect renewable energy sources to populated areas. Liquid hydrogen is a potential coolant for such applications.

Amalia Ballarino is the first CERN expert to earn the IEEE James Wong Award for her pioneering work on superconductors. She is the latest in a series of CERN experts to be awarded with similar IEEE prizes: Daniel Leroy, Lucio Rossi, Herman



ten Kate, Robert Aymar, Arnaud Devred and Luca Bottura were also all honoured

by the IEEE, which makes CERN home to more winners than any other institution.

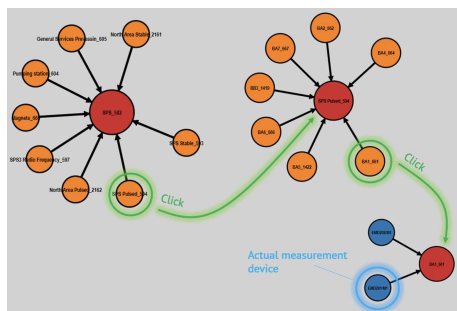
*a/leadership-in-superconductors-recognised/*).

Find out more about Amalia's work in the CERN Courier (<https://cerncourier.com/>)

Thomas Hortalá

## RELEASE OF THE WEBENERGY 2.0 TOOL: MANAGING YOUR ELECTRICITY CONSUMPTION AT CERN JUST GOT EASIER

The new version of the app has a sleek new design as well as new features to better forecast energy consumption on site



An example of navigation in the counting structure from a site (SPS) down to a physical measurement device (protection relay) available in the back end of WebEnergy 2.0. (Image: CERN)

It is no secret that the CERN accelerator complex consumes a vast amount of power – CERN's global electricity consumption can easily be compared to that of a small city. Understanding and modelling this consumption is key to drawing up CERN's annual budget as it helps forecast short-term and long-term needs [1] and bring about changes in behaviour towards more sustainable practices.

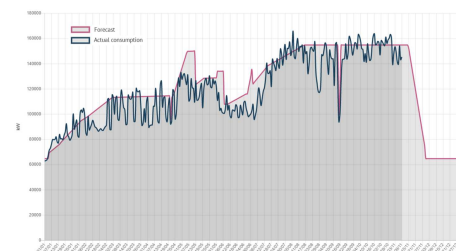
This is why the WebEnergy tool (<http://energy.cern.ch/>) (link only accessible

from within the CERN network) was initially created. Through its interface, users can plot the electrical energy consumption and average power data over time at various levels of detail. The tool is based on energy measurements from the medium voltage (18 kV or 3.3 kV) network, so the level of granularity does not reach 400/230 V consumer level. Data presented by WebEnergy can then be used for a multitude of applications, including reports and virtual invoices (e.g. EDMS 2599454 (<https://edms.cern.ch/document/2599454/2020.0>)), an activity carried out within the Energy Management Panel (EMP) to promote energy awareness and energy efficiency.

WebEnergy 2.0, the latest upgrade of the app, introduces a new design for front-end users, but the real innovation is on the back end: it makes updating the counting structure easier thanks to a visual editor (see Figure 2) and a user-friendly balloon interface. Moreover, WebEnergy 2.0 now includes an electricity forecasting tool, which generates a consumption profile based on the accelerator's planned operation.

WebEnergy 2.0 is an evolutive platform and new features will be coming. Most notably, the latest electricity forecast will soon be displayed on the front end and users will be able to navigate the counting structure in order to fully understand how energy is calculated and inform the Electrical Engineering group of potential discrepancies in the forecast.

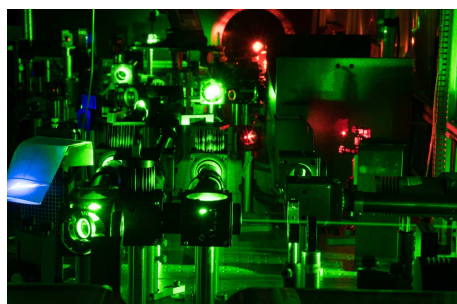
[1] CERN gets a monthly discount on electricity prices if the actual consumption is within 10% of the forecast.



Forecast vs actual consumption plot currently available at the backend of Webenergy 2.0. (Image: CERN)

## BISMUTH ISOTOPES ALSO ALTERNATE FROM SPHERES TO RUGBY BALLS

The unusual nuclear physics phenomenon, first discovered at CERN's ISOLDE facility 50 years ago, had until now been seen only in mercury isotopes



The ultrasensitive set-up used by the ISOLDE team to study bismuth isotopes. (Image: CERN)

Alternating from spheres to rugby balls is no longer the sole preserve of mercury isotopes, an international team at CERN's ISOLDE facility reports in a paper published in *Physical Review Letters*.

Isotopes are forms of a chemical element that have the same number of protons in their atomic nuclei but a different number of neutrons.

Atomic nuclei are usually spherical or nearly spherical. For a given element, though, when the number of neutrons changes, a gradual change in nuclear shape, or even a sudden one, can occur. However, 50 years ago, an experiment at ISOLDE revealed that the nuclei of mercury isotopes actually alternate dramatically in shape, from a sphere to a pronounced rugby ball, as single neutrons are removed from, or added to, the nucleus.

The finding remains one of the most remarkable discoveries in nuclear physics in the past five decades, and scientists have wondered ever since whether elements other than mercury also display this unusual 'shape-staggering' phenomenon.

The new study conducted at ISOLDE, the very same facility at which the phenomenon was discovered, has now delivered an answer to this question. By using ISOLDE's ultrasensitive Resonance Ionisation Laser Ion Source, the team behind the study has now shown that bismuth isotopes also display shape staggering.

Specifically, examining bismuth nuclei produced at a challenging low rate of less than one atom per second, the team found that the nucleus of bismuth-188, which has 83 protons and 105 neutrons, has a much larger radius than those of its closest nuclear neighbours, bismuth-189, with one more neutron, and bismuth-187, with one fewer neutron. Interestingly, such a sharp increase in radius, which reveals a change from a sphere to a pronounced rugby ball, occurs at the same number of neutrons, 105, as that at which shape staggering starts in the mercury isotopes.

"We had no indication from theory or experiment that bismuth nuclei would also ex-

hibit shape staggering," says Bruce Marsh of CERN and co-author of the study. "Such light bismuth nuclei are remarkably difficult to make and study, and our best nuclear physics theories lack the power to predict the shape of these and other complex nuclei."

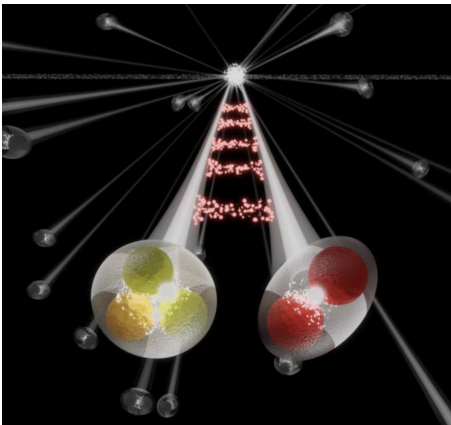
If this experimental result wasn't enough, the team gathered a unique collaboration of a dozen atomic-theory groups from five continents to extract nuclear properties from the ISOLDE measurements. At the same time, the researchers performed state-of-the-art nuclear theoretical calculations, paving the way to understanding the shape-staggering phenomenon.

"We can't tell whether or not we'll find another instance of shape staggering, but one thing is clear, this behaviour is no longer unique to mercury isotopes," concludes Marsh.

Ana Lopes

## ALICE TAKES THE NEXT STEP IN UNDERSTANDING THE INTERACTION BETWEEN HADRONS

The ALICE collaboration has for the first time observed the residual strong interaction between protons and phi mesons



An artistic representation of the interaction between a proton (consisting of two up quarks and a down quark) and a  $\phi$  meson (consisting of a strange-antistrange quark pair) as they emerge from a proton-proton collision at the LHC with a distance between them of the order of a femtometer. (Image: ALICE collaboration)

In an article recently published in *Physical Review Letters*, the ALICE collaboration has used a method known as femtoscopy to study the residual interaction

between two-quark and three-quark particles. Through this measurement, an interaction between the  $\phi$  (phi) meson (strange-antistrange quarks) and a proton (two up quarks and one down quark) has been observed for the first time.

Since the  $\phi$  meson is not electrically charged, an interaction between the proton and the  $\phi$  cannot be of electromagnetic origin and can only be attributed to the residual strong interaction. The strong interaction is what holds quarks together inside hadrons (such as the proton and the  $\phi$  meson), while the residual strong interaction is the force that acts between hadrons. This is the interaction that holds protons and neutrons together in the form of atomic nuclei.

Unlike the residual strong interaction between protons and neutrons, which can be studied in stable bound states like the nuclei, the interaction between unstable hadrons produced in particle collisions is

very difficult to observe. It was found to be possible in the LHC using an approach known as femtoscopy. Hadrons in the LHC collisions are produced very close to each other, at distances of about 10-15 fm (a unit known as a femtometer, hence the name femtoscopy). This scale matches the range of the residual strong force, giving the hadrons a brief chance to interact before flying away. As a result, pairs of hadrons that experience an attractive interaction will move slightly closer to each other, while, for a repulsive interaction, the opposite occurs. Both effects can be clearly observed through detailed analysis of the measured relative velocities of the particles.

The knowledge of the p- $\phi$  (proton- $\phi$  meson) interaction is of twofold interest in nuclear physics. First, this interaction is an anchor point for searches for the partial restoration of chiral symmetry. The left- and right-handed (chiral) symmetry that characterises the strong interaction is found to be broken in Nature, and this



effect is responsible for the much larger mass of hadrons, such as the proton and the neutron, with respect to the masses of the quarks that make them up. Hence, chiral symmetry is linked to the origin of mass itself! A possible way of searching for the restoration of chiral symmetry and shedding light on the mechanism that generates mass is to study modifications of the properties of  $\phi$  mesons within dense nuclear matter formed in collisions at the LHC. However, for this purpose, it is essential that the simple two-body  $p$ - $\phi$  interaction in vacuum is first understood.

The second point of interest is that, due to its strange-antistrange quark content, the

$\phi$  meson is regarded as a possible vehicle of the interaction among baryons (hadrons consisting of three quarks) that contain one or more strange quarks, called hyperons ( $Y$ ). Depending on the strength of this interaction, hyperons may form the core of neutron stars, which are among the densest and least understood astrophysical objects. Direct measurement of the  $Y$ - $\phi$  interaction strength, although feasible, has not yet been carried out, but already today this quantity can be estimated on the basis of the  $p$ - $\phi$  findings via fundamental symmetries. Therefore, measuring  $p$ - $\phi$  interaction provides indirect access to the  $Y$ - $Y$  interaction in neutron stars.

The moderate interaction strength measured by ALICE provides a quantitative reference for further studies of the  $\phi$  properties within the nuclear medium and also translates into a negligible interaction among hyperons in neutron stars. More accurate measurements will follow during the upcoming LHC Runs 3 and 4, allowing the precision of the extracted parameters to be significantly improved and also making it possible to pin down the  $Y$ - $\phi$  interaction directly.

ALICE collaboration

## COMPUTER SECURITY: MULTIFACTOR FOR THE MASSES



(Image: CERN)

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. 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. And you would know if your smartphone got lost, wouldn't you?

While, in 2020, CERN focused on rolling out two-factor authentication for experts needing to access and administer certain computing services, and while two-factor authentication will become mandatory for remote access to control systems installed on and connected to CERN's Technical Network ("Protecting the accelerator from remote evil" (<https://home.cern/news/>)),

[news/computing/computer-security-protecting-accelerator-remote-evil](https://home.cern/news/news/computing/computer-security-protecting-accelerator-remote-evil)"), in 2022, we would like to take the next step: using two-factor authentication when logging into *any* CERN web application.

The idea behind this new two-factor option is that CERN's web-based Single Sign-On (SSO) portal would require you to authenticate with both your password and your second factor for *any* website behind CERN's web-based SSO [1], regardless of whether it's 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. You can use a dedicated one-time password generation app on your smartphone – so your smartphone is that second hardware token – or a physical USB token (e.g. "Yubikey") that uses a CERN-dedicated private/public keypair for that second authentication step. Once authenticated correctly, you can continue working as normal and your session will stay active for 12 hours or until you change your browser or log in from another device. This would give you, your account and your data the ultimate protection against identity theft and password exposure.

Deployment of this silver bullet will pave the way for a wider roll-out in the future, but it requires a fundamental change in how authentication is done technically today. Hence, starting in the second quarter of 2022, all experts with access to critical control systems (e.g. via the BE department's ROGs), IT systems (e.g. using Foreman) or sensitive data, i.e. those experts already

using two-factor authentication on CERN's SSO for their work, will have this new two-factor web authentication feature enabled by default given the critical nature of their account (unless they opt out and also lose their privileged access). This will facilitate their login and avoid the need for multiple single- and multi-factor logins during the day. People who are using CERN computing facilities "only" for their research duties and scientific endeavours can opt into this feature through the IT User Portal, 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. So, why not give it a try for the sake of security and the protection of your account and digital life? Check out all the details (like how to activate a second factor or what to do if you lose it) on our dedicated webpage (<https://security.web.cern.ch/recommendations/en/2FA.shtml>).

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](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](mailto:Computer.Security@cern.ch).

[1] Non-web-based applications, like SSH bastion hosts, will continue to require 2FA only on a case-by-case basis.

Computer Security team

# Official communications

## SECURITY CAMPAIGN: UPDATE YOUR CERN ACCESS CARD BY 31 JANUARY 2022

### CERN access cards will need to be updated by 31 January 2022 for security reasons

All CERN access cards due to expire on or before 27 May 2026 must be updated before 31 January 2022. A warning banner on your personal ADaMs account will let you know if your access card is concerned.

The update, which consists in a quick (five to ten seconds) scan of your card, will be performed in one of three ways:

- At the registration service office (Building 55, first floor);
- At site entrances by security guards outside peak hours;
- At restaurant entrances.

As of Monday, 22 November 2021, security checks at the site entrances (starting with Prévessin and the inter-site tunnel) will be

slightly longer as security guards carry out the update on individual cards with each check.

As of 31 January 2022, entrance to the site will be denied to anyone carrying an out-dated access card. In January 2022, reminder emails will be sent out to those who have yet to update their cards.

## Announcements

## TRAFFIC DISRUPTIONS TO BE EXPECTED IN GENEVA ON THE WEEK OF 30 NOVEMBER – 3 DECEMBER

Please note that severe traffic disruptions should be expected in the Geneva region on the week of 30 November – 3 December due to the 12<sup>th</sup> Ministerial Conference of the World Trade Organization held in Geneva. Public transportation will also be adapted.

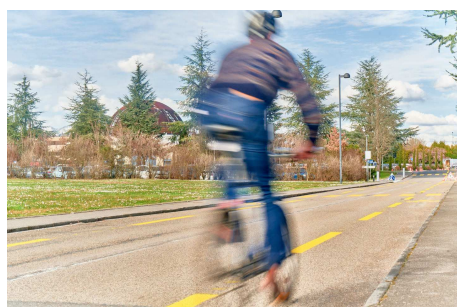
If you live in Geneva or usually commute through the city and want to avoid the worst of the jams, you are encouraged to take full advantage of the applicable teleworking offer, after discussion with your hierarchy and provided it doesn't clash with your professional imperatives.

In parallel, demonstrations are projected to disrupt public order in Geneva in the coming weeks. You are encouraged to follow the recommendations of the Police cantonale genevoise, which will be available on the police department's social media channels.

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## STAY SAFE AND KEEP ON PEDALLING

### Good practices and rules for cycling at CERN and in the Host States



Cycling to work is good for your health and the environment. Commuting to CERN by bike has been on the rise over the past years. As we enter the darker and colder months of the year, it is important to adapt and take additional precautionary measures when hitting the road.

Did you know that, in France, wearing a safety vest is mandatory when cycling at night and when visibility is poor (due to

fog, for example) outside urban areas? Wherever you live, as a cyclist, it is essential to be visible at all times by wearing high-visibility clothing and fitting out your bike with lights and reflectors.

Whatever the season, it is strongly recommended to wear a helmet. For e-bikes that have a pedal assistance of 25 km/h or more, Swiss traffic regulations make helmet-wearing mandatory. Remember that as a cyclist, you are subject to the same traffic rules as any other vehicle. Respect other road users' priority at cross-roads and remain wary of other vehicles' blind spots.

Vigilance and focus are key for road safety. For that reason, wearing earphones and headphones while riding a bike is forbidden in Switzerland and France.

CERN offers an e-learning module on bike safety with useful information on regulations and good practices. Taking the course is mandatory for anyone renting a CERN bike, and strongly recommended to anyone cycling on the Organization's premises.

If, despite observing the recommended practices, you are victim of an accident or a near miss, or if you encounter a dangerous situation on the CERN site, please do not forget to complete an incident declaration (<https://edh.cern.ch/Document/General/IncidentDeclaration>). These reports are used to improve safety at CERN, including road safety. By reporting an incident, you are helping to prevent similar occurrences and thus reduce the accident toll.

Stay safe.

HSE unit

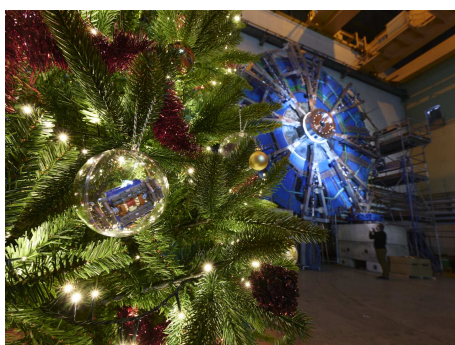
#### Useful links:

- E-learning module on bike riding
- Procedure for reporting accidents and near misses
- CERN bike rental
- Interactive tool for checking your bike equipment (French only)



A visibility vest helps you being seen from a greater distance

## END OF 2021 FESTIVITIES @ CERN



ATLAS 2019 Christmas tree (Image: CERN)

The Christmas holidays are around the corner, and many of you may wonder whether this can be marked at CERN.

COVID level 2 restrictions are currently in force on site and, with the rate of infections increasing in the local area, the Enlarged Directorate (ED) has decided that Christmas or end-of-year work team gatherings will not be authorised on site this year. While we all know how important end-of-year celebrations are for team spirit, a strict application of health-related measures remains key to keeping us all safe and reducing the risk of spreading the virus.

Beyond the CERN site, the COVID-19 restrictions in the Host States allow social gatherings, while stipulating self-isolation for all participants of such events if one of them tests positive. That's why the ED advises that working teams also avoid gather-

ings involving the whole team off the CERN site, as group self-isolation could seriously impact the work of the team.

Whatever your plans, and whoever you choose to socialise with, make your gatherings as safe as they can be by taking advantage of CERN's self-testing system, which is available at 11 testing points (<https://hse.cern/content/covid-19-auto-testing-places>) on site. Use the PLAMED platform (<https://plamed.web.cern.ch/>) to sign up for your self-test. In the event of symptoms, please self-evaluate and self-declare on TRAMED (<https://tramed.web.cern.ch/>).

Stay safe and enjoy the winter cheer.

## 22 NOVEMBER TO 9 DECEMBER: ROAD WORKS ON ROUTE BLOCH

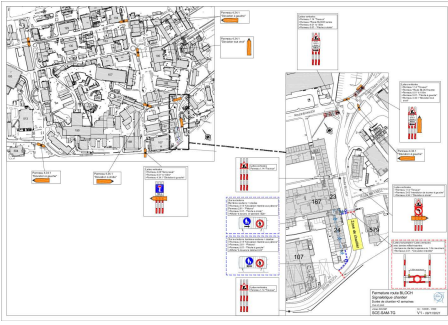


(Image: CERN)

There will be works on Route Bloch from **Monday 22 November 2021 at 8 a.m. until Friday 3 December at 5.30 p.m.**, to allow for the installation of a new sewage disposal system.

A detour will be set up via Routes Salam and Bakker.

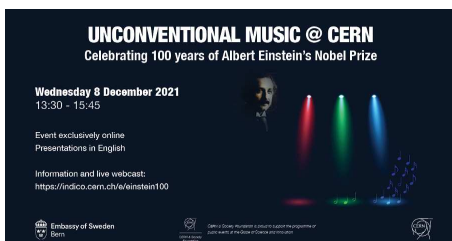




Expected detours via Routes Salam and Bakker  
(Image: CERN)

## UNCONVENTIONAL MUSIC @ CERN: CELEBRATING 100 YEARS OF ALBERT EINSTEIN'S NOBEL PRIZE

To celebrate Einstein's love of music and science, the Swedish Embassy in Switzerland and CERN have organised the virtual event **Unconventional Music @ CERN on the Nobel Week**



(Image: CERN)

The Globe of Science and Innovation at CERN will host an online event including a concert with unconventional instruments (one theremin and a noise table) in musical conversation with top CERN scientists on Wednesday 8 December 2021 to celebrate the anniversary of Albert Einstein's Nobel Prize.

Albert Einstein was awarded a Nobel Prize in December 1921, to honour his contributions to theoretical physics and his discovery of the law of the photoelectric effect.

Because of his innumerable contributions to science, Einstein is considered the fa-

ther of modern physics, but he was also an accomplished violinist who loved music.

*"If I were not a physicist, I would probably be a musician. I often think in music. I live my daydreams in music. I see my life in terms of music... I get most joy in life out of music." - Albert Einstein*

At the time Einstein received the Nobel Prize, a Russian engineer, Lev Termen, was laying the foundations of modern electronic music with his invention, the theremin. It was a technically advanced instrument relying on the progress in the scientific field at the time. Curious of this instrument, Einstein attended various concerts and even tried to play it.

Einstein and Nobel are two great minds whose legacies are as important today as ever. Albert Einstein had a strong connection to Switzerland. He studied in Aarau and Zürich, then researched in Bern before becoming a teacher at ETH in Zürich.

CERN and the Swedish Embassy found that unconventional music performed by a Swiss (Roland Bucher) and a Swedish (Henrik Rylander) artist in conversation with CERN scientists and musicians is an excellent way to celebrate Albert Einstein's Nobel Prize anniversary.

Talks about Einstein, music and physics given by Prof. Brian Foster (University of Oxford) and Dr. Piotr Traczyk (CERN) will be followed by music performances of invited artists and CERN scientists and musicians: Pippa Wells, Paula Collins, Chiara Mariotti and Angela Ricci.

Join the live webcast (<https://webcast.web.cern.ch/event/i1093427>) from CERN's Globe of Science and Innovation on Wednesday 8 December at 1.30 p.m. and celebrate science with us.

Programme and information:  
<https://indico.cern.ch/event/1093427/>

## GREENING “BLACK FRIDAY”: SALE OF THE HOTEL'S FORMER FURNITURE



(Image: CERN)

The CERN community is invited to an exclusive sale of second-hand furniture, decorative items and equipment on **Friday November 26 from 8.30 a.m. to 11.30 a.m. and 1.30 p.m. to 4.00 p.m. in building 133.**

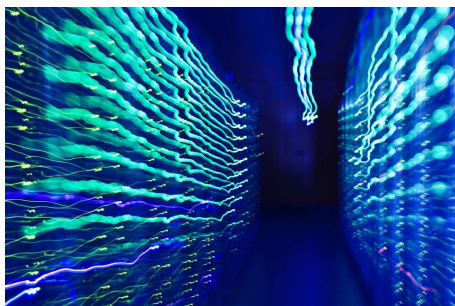
The CERN hotel in building 38 has been completely renovated. Its former furnishings will go on sale on Friday, 26 November 2021 (“Black Friday”).

Don't miss this unprecedented sale organised by the Sales & Recuperation Service and the CERN Hotel Management Team.

This operation directly contributes to the recycling policy and sustainability to which our Organization is committed.

*SCE department*

## JOIN US AT THE CERN QTI WORKSHOP TO GET UPDATED ON THE INITIATIVE AND DISCUSS FUTURE PROJECTS



(Image: CERN)

in discussing the state of the art of the initiative and future projects in:

- quantum computing and algorithms;
- quantum theory and simulation;
- quantum sensing, metrology and materials;
- quantum communication and networks.

When registering, there will be an opportunity to submit an abstract for new project proposals for discussion at the workshop. We encourage people to get ready to present these during the event.

To register for the session, please visit: <https://indico.cern.ch/event/1098355/>

For more information about CERN QTI, please see our website, [quantum.cern](https://quantum.cern/) (<https://quantum.cern/>), subscribe to our monthly newsletter (<https://quantum.cern/form/cern-qi-newsletter-subscription>) and follow us on Twitter (<https://twitter.com/CERNquantum>) and LinkedIn (<https://www.linkedin.com/showcase/cern-quantum-technology-initiative-cern-qi/?viewAsMember=true>).

As a follow-up to the recently launched roadmap of the CERN Quantum Technology Initiative, the CERN QTI internal workshop will take place online on 10 December from 9.00 a.m. to 12.00 p.m. (CET). The event is open to all members of the CERN community who are interested

The upcoming workshop will review the ongoing CERN QTI projects and the recent progress achieved. The focus will be to expand CERN-wide collaboration across the Laboratory's various activities, detail the resources currently available and provide a forum to discuss new ideas and projects.

## ALUMNI EVENT ON 9 DECEMBER – “NEWS FROM THE LAB: CHALLENGES AND PERSPECTIVES FOR TARGET SYSTEMS OF HIGH-INTENSITY AND HIGH-ENERGY MACHINES”



Marco Calviani and Cristina Bahamonde are the speakers of this “News from the lab” event (Image: CERN)

The latest edition of the “News from the Lab” event series will tackle the challenges faced by beam intercepting devices and will take place on Thursday 9 December from 6 p.m. to 7 p.m.

Marco Calviani and Cristina Bahamonde will discuss the material and production techniques R&D required to face the ever increased operational demands of high-

energy physics machines. Specific focus will be provided on Target Systems components, required to produce secondary particles for different applications.

For more information on the talks and Zoom details, please register here: <https://alumni.cern/events/70604>

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## SPRINGER BOOK FAIR - 6 AND 7 DECEMBER 2021

The Springer book fair will take place in the Main Building (bldg. 500) on the ground floor near the Restaurant 1 on Monday 6 and Tuesday 7 December 2021, from 8:30 a.m. to 2 p.m.

New books from the publisher Springer will be on display and sale.

The sale will take place in compliance with the Covid-19 protective measures, i.e.:

- physical distancing

- mask wearing

- use of hand sanitiser before touching the books (sanitiser will be available)

We look forward to seeing you!

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## FIFTH FCC PHYSICS WORKSHOP AT THE UNIVERSITY OF LIVERPOOL, 7–11 FEBRUARY 2022



(Image: CERN)

For the first time since the launch of the FCC feasibility study, the FCC physics community will gather in hybrid format (in person and online) for the fifth FCC physics workshop, which will take place at the University of Liverpool from 7 to 11 February 2022.

Registration and abstract submission are open on the Indico page of the workshop, where you will also find details and references about the event.

Up to 150 participants will be allowed on site on a “first registered, first served” basis in line with existing COVID-19 and social distancing protocols and recommendations. Remote participants will be able to attend all the plenary and parallel sessions via Zoom, while the poster session and all networking and social events will be for in-person participants only.

**Online registration on Indico** (<https://indico.cern.ch/event/1066234/>)

## Ombud's corner

### KNOWING HOW TO SET LIMITS FOR OURSELVES AND OTHERS

We all have our own needs and our own limits. They are part of our personality and can change over time as our personal and professional lives evolve.

Peter<sup>\*</sup> is reserved and somewhat introverted. He is appreciated by his colleagues for his kind nature and the quality of his work and never says “no” if asked to do something. When his supervisor assigns him new tasks on top of the many duties that he's already struggling to cope with, he agrees, as he's afraid to speak up about how difficult it's going to be for him. He starts to feel anxious and to have difficulty sleeping, which has a knock-on effect on his work.

All the members of Marie's<sup>\*</sup> team have their work cut out to meet the objectives that have been set for the team. Marie is demanding but works very hard herself and gives praise where it's due. She's proud of her team and always expects them to go the extra mile. One of the team members, Elena<sup>\*</sup>, is often the one who's called upon when there's an urgent job to be done. She has fewer family commitments than some of the other team members and never refuses, but Marie's never-ending demands are causing her to feel anxious and uncomfortable. She blames herself for never being able to say “no”, whereas other team members have no problems setting limits on what they're prepared to do.

Low self-confidence, an excessive respect for or fear of the management hierarchy and a fear of conflict or being judged negatively are the main causes of a lack of assertiveness, both in the workplace and in our personal lives. **We all have different ways** of giving our best at work and a different approach to coping with the difficulties and challenges we encounter.

Refusing to leave our comfort zone when we're asked to do so is not what's at stake here. Our comfort zone is determined by our technical and behavioural skills at a given point in our career. Stepping out of it can be a rewarding experience when we receive the appropriate training, support and follow-up. Instead, it's a matter



of being able to say “no” at times when we feel that we’ve reached our limits and that trying to do what’s being asked of us would see **our workload encroach further on our well-being**.

People who find it hard to assert themselves have a tendency to take on too much, forever saying “yes” to urgent tasks and jobs that are not their responsibility and that build up to upset their well-being in the workplace. In many cases, they agree to do them in order to feel valued and appreciated. Contract insecurity and career implications are other factors that can make them afraid of saying “no”.

If we’re unable to set limits, we’re prone to a range of negative consequences, from feelings of guilt to a loss of self-esteem, anxiety and exhaustion. It’s not easy to stay motivated, efficient and productive in such circumstances.

It’s essential that **we take responsibility for our own well-being** and are able to say “no” when we’ve reached our limits. It’s also important to know how to say “no”. If we’re too abrupt and emphatic in our refusal and fail to show empathy, which can often happen if we’re afraid of not being able to stand firm against the other person’s insistence, the chances are that our response will trigger a negative reaction or even lead to conflict and this, in turn, will only reinforce our idea that it’s dangerous to say “no”.

If we want to learn how to say “no”, we can start by saying “yes, as long as...”. For example, “Yes, I’d be happy to take on the running of the working group, as long as you allow me to give up the other weekly meeting”. Or “Yes, I can certainly work late tonight to finish the work you want me to do, as long as you can give the other urgent job to another colleague”.

***Assertiveness is an attitude that requires us to find the right balance between our own needs and limits and those of the other people concerned. It means expressing our needs and limits in a constructive and empathetic way, which is not always easy. To learn how to say “no” when you’ve reached your limits, start by saying “yes, as long as...”.***

*Laure Esteveny*

\*) Names have been changed

*I want to hear from you – feel free to send an e-mail to [ombud@cern.ch](mailto: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 at: [CERN Ombud news](#).*