CERN Bulletin

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Accelerating stroke prevention

The same algorithms used to diagnose anomalies in CERN's accelerator chain have the potential to detect brain pathologies such as strokes

(Image: Gorodenkoff via Getty Images)

The complex system of the CERN accelerator chain requires immense precision in order to operate. To address this need, CERN researchers developed artificial intelligence (AI) algorithms that predict and diagnose anomalies, minimising failures and keeping our infrastructure working around the clock. The same algorithms have the potential to improve people's lives when applied to complications that occur in the human body.

The CAFEIN* platform was developed at CERN in collaboration with Consiglio Nazionale delle Ricerche and Politecnico di Milano in Italy to address challenges in both fundamental research and medicine. In particular, in the latter, it enables the detection of pathologies in the human body (such as brain pathologies) and predicts the risk of disease recurrence.

Among brain pathologies, stroke is one of the leading causes of severe disability worldwide. It is associated with a significant social and economic burden, which will dramatically increase over the coming decades due to the ageing population.

By correctly assessing a stroke patient's risks and potential outcome, it is possible to provide improved and personalised treatment to help prevent relapse. The TRUSTroke project** was developed to ensure that as many patients as possible are treated and to reduce the numbers of patients discharged too early from hospital.

Contents

Under the coordination of Vall d'Hebron, a leading healthcare campus in Barcelona, CERN and eleven other partners from across Europe joined forces to assist clinicians, caregivers, and patients by creating AI algorithms using data confined to the hospital environment, which is the key feature of the CAFEIN platform. This approach, which uses local data samples without exchanging them, is known as Federated Learning (FL), and it can guarantee the confidentiality of patient data by sharing only the necessary information without sharing any individual's personal data.

"AI algorithms trained using FL platforms like CAFEIN are being applied more and more in the medical domain, where privacy prevents the sharing of personal data. In addition to the ongoing TRUSTroke project, CERN's developments are being used at the Medical School of the National and Kapodistrian University of Athens in brain-pathology screening using MRIs or, more recently, to develop risk-based cancer screening tools with the International Agency for Research on Cancer (IARC).", says Luigi Serio, principal investigator in the Technology Department at CERN.

Two online public events have been organised to provide more information on the project:

- "TRUSTroke webinar on Federated Learning" on 28 September, 12.00 p.m. More information: https://indico.cern.ch/e/trustrokewebinar
- "How AI and a CERN federated learning platform can assist clinicians in the management of stroke patients" on 29 September, 9.00 p.m. More information: https://indico.cern.ch/e/trustroke.

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**The Computer-Aided deFEcts detection, Identification and classificatioN (CAFEIN) project has received support from the CERN budget for knowledge transfer to medical applications through a grant awarded in 2019. https://kt.cern/kt-fund/projects/cafein-federated-network-platform-development-and-deployment-ai-based-analysis-and*

***The TRUSTroke project is funded by the European Union in the call HORIZON-HLTH-2022-STAYHLTH-01-two-stage under grant agreement No. 101080564.*

Accelerator Report: Getting lead ions ready for physics

This reference international standard provides a practical way to improve energy performance

In about a week, lead ions will be sent from the SPS into the LHC to collide in the accelerator's four big experiments – ALICE, ATLAS, CMS and LHCb. This is a particular highlight for the ALICE collaboration, which has been eagerly awaiting lead-ion collisions since the end of Long Shutdown 2 (LS2), when its detector was upgraded. ALICE (A Large Ion Collider Experiment) is a detector dedicated to heavy-ion physics. It is designed to study the physics of strongly interacting matter at extreme energy densities, where a phase of matter called quark-gluon plasma forms.

The following week, the SPS will also provide slow-extracted lead-ion beam pulses of 4.5 seconds per cycle to the North Area experiments. The NA61/SHINE experiment is the main user of lead ions in the North Area, but other users will also benefit from these during the short period they are available.

In the last two weeks of the 4-week 2023 run, the PS will provide lead ions to the East Area, where the CHIMERA facility irradiates electronics with high-energy heavy ions to study the effects of cosmic radiation on electronics used in the CERN accelerators and experiments, as well as for space missions and avionics.

Although the lead-ion physics period is relatively short, it is of great importance, and special care is taken by the experts and operations teams to provide high-quality beams.

The origin of lead ions and lead-ion beams

Lead ions are "born" in the source of Linac3, where a pure lead sample is evaporated: oxygen gas and lead vapour are injected into the source plasma

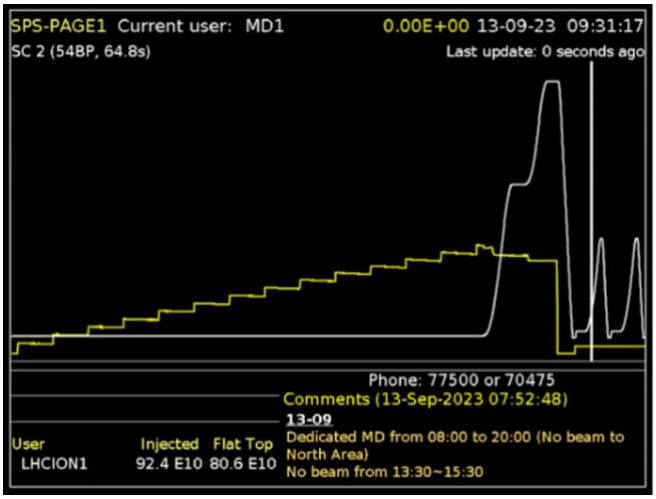
chamber. A microwave is applied to create the plasma in which the lead and oxygen atoms are ionised. These ions are then extracted, partially stripped and accelerated. The lead-ion charge after the stripping process is 54+, meaning that 28 of the 82 electrons have been removed (a lead atom originally has 82 electrons).

These lead ions are then transported and injected into the next machine in the chain, LEIR (Low Energy Ion Ring), which can receive single or multiple pulses, depending on the beam intensities needed (the more pulses, the more lead ions accumulated and the higher the intensity).

For the LHC beam, LEIR receives seven pulses from Linac3, each of which is cooled using electron cooling to reduce the beam size. In this process, a "cold" electron beam is sent along over a distance of 2.5 m with the "hot" lead-ion beam. The exchange of energy between the two beams reduces the beam size of the lead-ion beam, leaving space to inject another pulse from Linac3 and repeat the cooling process. Finally, two bunches are accelerated and extracted towards the PS.

The PS further accelerates the two-bunch beam and performs several longitudinal beam manipulations using the radiofrequency (RF) cavities to finally obtain four bunches spaced by 100 ns. After up to 14 cycles, these four bunches of Pb^{54+} ions are then transported to the SPS. In the transfer line between the PS and the SPS, the ions are fully stripped of their remaining electrons to become Pb^{82+} ions divided into 56 bunches spaced by 100 ns.

After an initial acceleration in the SPS, the beam is slip-stacked (see box) to reduce the bunch spacing to 50 ns, thus doubling the total lead-ion beam intensity in the LHC. Following a final acceleration phase, the beam is extracted and injected into the LHC, either in a clockwise or counter-clockwise direction. The LHC will be filled with up to 1248 bunches per beam.



The SPS lead-ion beam production cycle for the LHC. In yellow, the beam intensity increases in 14 steps, representing the 14 injections from the PS. (Image: CERN)

As I write this article, the Linac3, LEIR and PS machines are producing lead-ion beams on a routine basis. The focus is now on completing the commissioning of slip-stacking in the SPS; this process is already well advanced and it looks likely that slip-stacked ion beams will be delivered to the LHC in the coming weeks.

A new method to reduce bunch spacing for lead ion beams

Over the last few years, the CERN ion injector complex has undergone a series of upgrades in preparation for a doubling of the total intensity of the lead-ion beams for the HL-LHC. In the SPS, teams began using a technique known as "momentum slip-stacking", which involves injecting two batches of four lead-ion bunches separated by 100 nanoseconds to produce a single batch of eight lead-ion bunches separated by 50 nanoseconds.

In this process, the 56 bunches injected into the SPS are divided among two RF systems, which each receive 28 bunches. As there is a small frequency difference between these two RF systems, half of the beam travels slightly faster along the SPS circumference (known as "slipping"). Once the two halves of the beam are placed so that the space between two bunches is 50 ns, the beam is interleaved (or "stacked"). This allows the total number of bunches injected into the LHC to increase from 648 in Run 2 to 1248 in Run 3 and subsequent runs.

Rende Steerenberg

Promoting the quality of working life

The "Efficiency and caring at work" awareness campaign will be launched this autumn as part of the "Work Well Feel Well" project, which began in 2017

The "Work Well Feel Well" (*"Bien dans son travail"*) project was launched by the Director-General in 2017 and has become one of the pillars of mental health at CERN. It aims to promote and improve the quality of working life at CERN, in particular by tackling the adverse effects of stress. The project is led by a multidisciplinary working group, with members of the HR Department, the HSE Unit, the Staff Association and the Ombud. Since its inception, several measures have been implemented to reduce stress factors at CERN, to boost resilience to stress and to help those affected through a number of support structures.

"The first phase of the project highlighted some particularities of CERN", explains Marie-Luce Falipou, project leader. "The survey conducted in 2018 revealed that, although CERN is a demanding workplace, it offers personnel a degree of job autonomy as well as social support through mutual aid from their colleagues and line management, and this fosters a high-quality work environment. Work organisation, team management and communication emerged as key areas to develop in order to ensure good working conditions."

Even so, CERN staff are not immune to stress and its effects, and the COVID-19 pandemic will have had a serious impact on people's mental health. "During the pandemic, we worked closely with managers, who play an important role in the professional well-being of their teams, with whom they are in direct contact", says Marie-Luce Falipou. "And to continue this work, which is still relevant today, I am pleased to announce that the project team will launch the '**Efficiency** and **caring** at work' awareness campaign. 'Caring at work' means wanting the best for ourselves and those around us and taking care of each other no matter what."

This awareness campaign is made up of 12 thought-provoking topics – all you have to do is take part. Fun exercises will help you explore, deepen your knowledge and share your experiences in your search for a better quality of life at work. To work efficiently in the medium-term, we need to be proactive in preserving our energy and health every day. The campaign also includes activities aimed at line managers, providing key information on how to take concrete action on a daily basis to reduce stress and improve working conditions for their teams. **Because doing a good job and feeling good at work go hand in hand!**

The official launch will be on 6 October, when Catherine Vasey*, Swiss burn-out specialist and designer of this campaign, will give a lecture on preventing burn-out.

"Through this new campaign, we hope to promote mental health at work and remind CERN personnel that stress is not inevitable and deserves our full attention", concludes Marie-Luce Falipou.

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** Catherine Vasey is a psychologist and author who has specialised in burn-out since 2000. For more information on the conference and to register, visit: https://indico.cern.ch/event/1302707/.*

conditions."

Anaïs Schaeffer

Quest for the curious magnetic monopole continues

ATLAS experiment places some of the tightest limits yet on magnetic monopoles

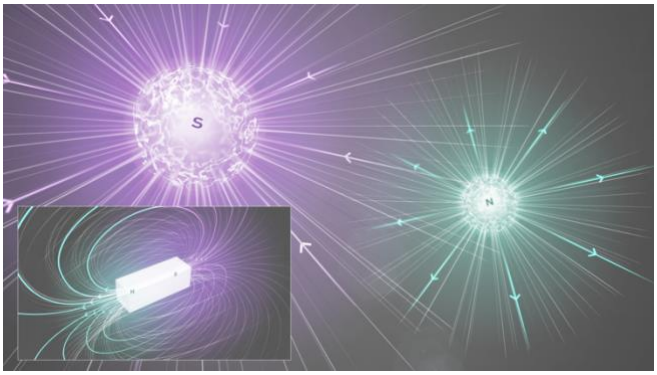


Illustration of magnetic monopoles (larger image) and a magnetic dipole (inset) (Image: CERN)

Magnets, those everyday objects we stick to our fridges, all share a unique characteristic: they always have both a north and a south pole. Even if you tried breaking a magnet in half, the poles would not separate – you would only get two smaller dipole magnets. But what if a particle could have a single pole with a magnetic charge? For over a century, physicists have been searching for such magnetic monopoles. A new study from the ATLAS collaboration at the Large Hadron Collider (LHC) places new limits on these hypothetical particles, adding new clues for the continuing search.

In 1931, physicist Paul Dirac proved that the existence of magnetic monopoles would be consistent with quantum mechanics and require — as has been observed — the quantisation of the electric charge. In the 1970s, magnetic monopoles were also predicted by new theories attempting to unify all the fundamental forces of nature, inspiring physicist Joseph Polchinski to claim that their existence was "one of the safest bets that one can make about physics not yet seen." Magnetic monopoles might have been present in the early Universe but diluted to an unnoticeably tiny density during the early exponential expansion phase known as cosmic inflation.

Researchers at the ATLAS experiment are searching for pairs of point-like magnetic monopoles with masses of up to about 4 teraelectronvolts (TeV). These pairs could be produced in 13 TeV collisions between protons via two different mechanisms: "Drell-Yan", in which a virtual photon produced in the collisions creates the magnetic monopoles, or "photon-fusion", in which two virtual photons radiated by the protons interact to create the magnetic monopoles.

The collaboration's detection strategy relies on Dirac's theory, which says that the magnitude of the smallest magnetic charge (g_D) is equivalent to 68.5 times the fundamental unit of electric charge, the charge of the electron (e). Consequently, a magnetic monopole of charge $1g_D$ would ionise matter in a similar way as a high-electric-charge object (HECO). When a particle ionises the detector material, ATLAS records the energy deposited, which is proportional to the square of the particle's charge. Hence, magnetic monopoles or HECOs would leave large energy deposits along their trajectories in the ATLAS detector. Since the ATLAS detector was designed to record low-charge and neutral particles, the characterisation of these high-energy deposits is vital to the search for monopoles and HECOs.

In their new study, the ATLAS researchers combed through the experiment's full dataset from Run 2 of the LHC (2015–2018) in search of magnetic monopoles and HECOs. The search made use of the detector's transition radiation tracker and the finely segmented liquid-argon electromagnetic calorimeter. The result places some of the tightest limits yet on the rate of production of magnetic monopoles.

The search targeted monopoles of magnetic charge $1g_D$ and $2g_D$ and HECOs of electric charge $20e$, $40e$, $60e$, $80e$ and $100e$, with masses between 0.2 TeV and 4 TeV. Compared to the previous ATLAS search, the new result benefited from the larger, complete Run-2 dataset. This was also the first ATLAS analysis to consider the photon-fusion production mechanism.

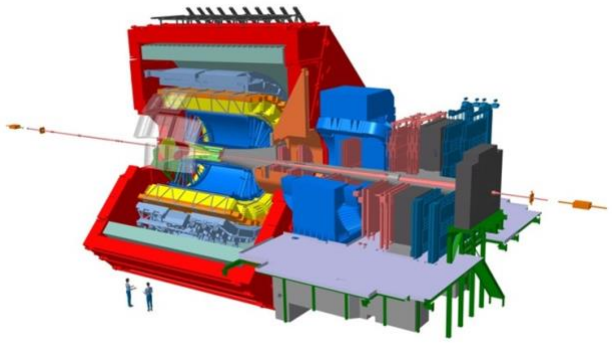
With no evidence of either magnetic monopoles or HECOs in the dataset, the ATLAS researchers established new limits on the production rate and mass of monopoles with a magnetic charge of $1g_D$ and $2g_D$. ATLAS remains the experiment with the greatest sensitivity to monopoles in this charge range; the smaller LHC experiment MoEDAL-MAPP

has previously studied a larger charge range and has also searched for monopoles with a finite size. ATLAS physicists will continue their quest to find magnetic monopoles and HECOs, further refining their search techniques and developing new strategies to study both Run-2 and Run-3 data.

ATLAS collaboration

ALICE reports new charmonia measurements in LHC Run 3

The ALICE collaboration presents its first results based on data collected with the upgraded detector in 2022, the first year of Run 3 of the LHC, at the 2023 Quark Matter conference



3D drawing of the ALICE detector. (Image: CERN)

Earlier this month, almost 700 physicists from all over the world met in Houston, Texas, to attend the 30th edition of the Quark Matter conference, the largest conference in the field of heavy-ion physics. At this meeting, the ALICE collaboration presented its first results based on data collected with the upgraded detector in 2022, the first year of Run 3 of the LHC. Before the start of Run 3, ALICE underwent a major upgrade of its experimental apparatus to allow the recording of 50-100 times more Pb-Pb collisions and up to 500 times more proton-proton collisions than in previous runs. In addition, upgrades of the tracking detectors improved the pointing resolution by a factor 3-6. All in all, many new high-precision results will become available in the coming years.

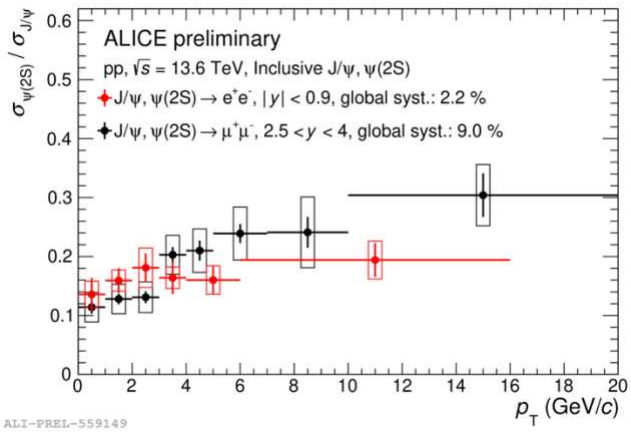
One of the new results presented at the Quark Matter conference was the measurement of the production of two different states of charmonia in proton-proton collisions. Charmonia are particles that consist of a charm and an anti-charm quark, with a total mass of about 3 GeV, more than 3 times that of the proton. Charmonia have a characteristic decay signature, producing an electron-positron pair or a positive and a negative muon.

There are a variety of charmonium states, with different binding energies, from the tightly bound J/ψ (binding energy of approximately 650 MeV) to the weakly bound – and two times larger – ψ(2S) (binding energy of 50 MeV). In heavy-ion collisions, these states melt in the quark–gluon plasma (QGP) and a reduced number of them is observed in the final state, a phenomenon known as charm suppression. Physicists can determine the temperature of the plasma by measuring how the different states are suppressed. Such measurements have played an important role in the field over the years, starting from early measurements at the SPS in the 1990s.

The key to measuring charmonium suppression is knowing the production rates. These rates can be determined by measuring the production of quarkonia in proton-proton collisions, where there is no suppression. This provides the reference for the measurements performed in Pb-Pb collisions.

The upgraded ALICE detector has a broad kinematic coverage that allows it to study J/ψ and ψ(2S) down to zero transverse momentum in two different and complementary regions. In the central region, charmonium is reconstructed from its decay into an e^+e^- pair in the central barrel detectors, while in the forward region it is detected in its decay channel $\mu^+\mu^-$, in the muon spectrometer.

The proton-proton statistics collected in LHC Runs 1 and 2 allowed ALICE to study the ψ(2S) yields in the forward region, but not in the central region. The data from 2022 represents an increase of the total number of collisions by a factor of 300, making it possible to measure the production rate of the ψ(2S) in the central region for the first time.

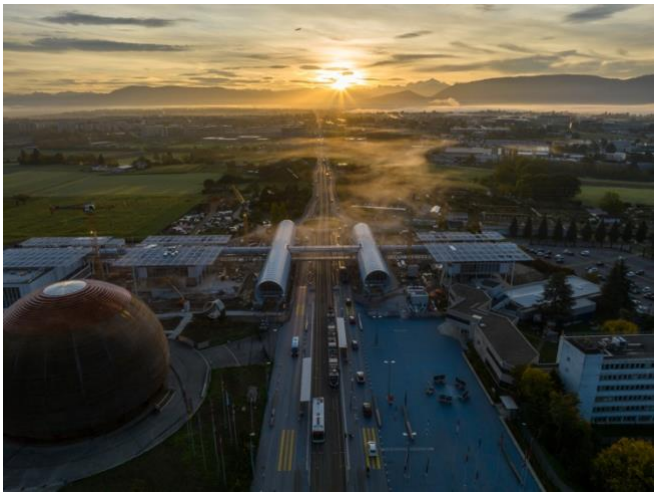


Ratio of ψ(2S) to J/ψ in LHC Run 3 proton-proton collisions as a function of transverse momentum, showing ALICE's capability for measurements of the excited and ground charmonium states in the central (red points) and forward (black points) region. (Image: ALICE)

ALICE collaboration

CERN Science Gateway: pre-inauguration for the CERN community

On 19 and 20 September, Science Gateway will open its doors to the CERN community with a pre-inauguration and visits



CERN Science Gateway. (Image: CERN)

In a few weeks, on 7 October, CERN will formally inaugurate CERN Science Gateway. As our Director-General, Fabiola Gianotti, noted in her email to personnel on 11 September, this is a project to which many of you have contributed and which we all look forward to becoming a unique place where visitors of all ages, from near and far, will learn all about CERN's science and people. She has invited the CERN community and families to a pre-inauguration of Science Gateway on 19 and 20 September.

Please note that, contrary to the original announcement, **visitors must be over 18 years of age**. This is due to safety reasons, as Science Gateway will still be a construction site. Thank you for your understanding. From 8 October, you will be able to visit with family members of all ages.

Many of you have expressed interest and we have received several questions, which we will address here:

Do family members need a CERN Access card?

Accompanying family members over the age of 18 (see above) will need to have their CERN Access card with them. If they do not have a CERN Access card, they can obtain one at building 55. More details are available in the CERN admin e-guide (https://admin-eguide.web.cern.ch/en/procedure/cern-access-card).

Do I need to register?

You must register for the pre-inauguration talk on Tuesday 19 September at 1.30 p.m. You do not need to register for anything else during the two days. More details here (https://indico.cern.ch/event/1319379/).

Will I be able to see all areas of CERN Science Gateway?

This pre-inauguration, including the visits, will take place during the final, intense stage of preparing for the formal inauguration on 7 October and the opening to the public as of 8 October. Several

areas of the building are a worksite, so for safety reasons some areas may be cordoned off.

Will there be hands-on activities?

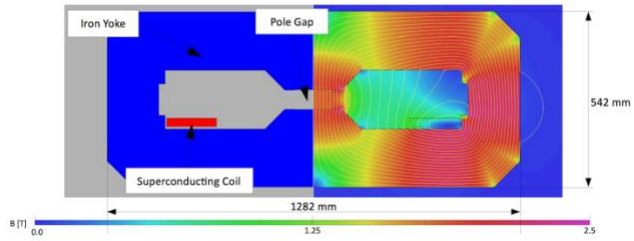
The visits will be an experience of looking rather than experimenting with the exhibits and lab activities. This will allow work to carry on, to have everything ready for the opening to the public. Thank you in advance for your understanding.

You can find more information here (https://indico.cern.ch/event/1319379/).

Ana Godinho

A new generation of iron-dominated electromagnets has been successfully tested at CERN

The proof-of-principle demonstrator could pave the way for more energy-efficient electromagnets



A cross-section of the proof-of-principle demonstrator, with geometry (left) and magnetic flux density lines (right). The useful aperture in the pole gap is 150 x 62 mm (horizontal x vertical) for a magnetic length of 1 m. The total mass of the iron is 4500 kg, and the developed length of the MgB_2 cable is 85 m. (Image: CERN)

Many physics experiments at CERN require moderate magnetic fields (around 2 tesla) in a large gap over a large volume. These are currently created by normal-conducting, iron-dominated electromagnets. While robust and reliable, these resistive magnets require significant electrical power – in the MW range – and therefore can be costly to operate.

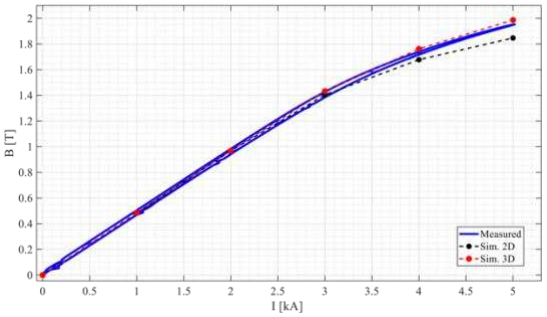
To combat this, engineers from the CERN TE-MSC group are investigating intermediate temperature superconductors (operating at 20 kelvin and above) to be used in the coil winding of electromagnets with the aim of increasing magnet efficiency. They have now designed, manufactured and successfully tested a conductor for use in these electromagnets. This proof-of-principle demonstrator is a superconducting coil wound from a magnesium diboride (MgB_2) cable mounted inside an iron yoke. As a first step, the demonstrator was tested at 4.5 K, where it reached the expected magnetic field. The group designed the demonstrator to be easily scalable to large, iron-dominated electromagnets, such as some of the magnets needed for the Search for Hidden Particles (SHiP) experiment. The innovative design could also be retrofitted to existing magnets by replacing the normal-conducting coils with the new coils.

The MgB_2 cable is one of the units manufactured for the Superconducting Link of the High-Luminosity Large Hadron Collider (HL-LHC) at CERN. The MgB_2 strands were developed by CERN together with ASG S.p.A during the R&D phase of the HL-LHC Cold Powering work package and were produced by ASG S.p.A. The MgB_2 cable was also developed by CERN and then industrialised for production in long lengths by Tratos Cavi S.p.A, a member of the ICAS consortium. The iron yoke and the winding formers were fabricated with the support of CERN EN-MME.

The demonstrator magnet in the horizontal position, during the last stages of assembly (left), as well as when attached to a vertical insert for testing in one of the CERN SM18 cryogenic test stations (right). (Image: CERN)

For the initial test, the engineers cooled the demonstrator down to 4.5 K with liquid helium and successfully ramped it up to 5 kA, the design current, without any resistive transition or resistive voltage across the coil. They then

warmed it up to room temperature and cooled it again to 4.5 K: the magnet again reached the target current of 5 kA after this thermal cycle, with no quench. Magnetic measurements at cryogenic temperature confirmed that the demonstrator met design expectations, both in terms of field strength – the magnetic field in the pole gap is 1.95 T at 5 kA – and field quality.



The measured dipole magnetic field in the centre of the magnet compared to simulations. (Image: CERN)

"These encouraging results demonstrate the robustness of the MgB_2 cable and the suitability of its coil design for iron-dominated electromagnets," explains TE-MSC group leader Arnaud Devred. "The team warmly thank Richard Jacobsson for inspiring this work, Davide Tommasini for his exploratory feasibility study and José Miguel Jimenez for his unconditional support for this project."

The next step for the team is to work with the CERN TE-CRG group to carry out a test of the demonstrator in gaseous helium at 20 K. Ultimately, the coil will be inserted into a dedicated cryostat to enable its operation at 20 K while keeping the surrounding iron yoke at room temperature.

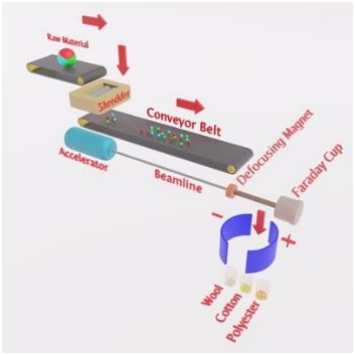
TE department

Accelerating circular fashion

What role could particle accelerators play in recycling textile waste?

The "FabRec" student team used an image of dumped clothing in the Atacama Desert in Chile to highlight the importance of recycling textile waste. (Image: CERN)

Currently, only 1% of textile waste is recycled into new clothes. Recycling textile polymers is a costly and challenging task, as is the separation and recycling of blended textiles – complex mixtures of different fibres, often cotton or wool with synthetic materials. Could particle accelerators solve the problem of textile waste and contribute to circular fashion?



The student team proposed to separate textile fibres using an electron beam from a Van de Graff accelerator. (Image: FabRec team)

This was the subject of the winning project at this summer's challenge-based innovation event, held by the EU-funded I.FAST project. A multi-disciplinary team of students proposed the use of an electron beam to segregate different fabric components through electrostatic separation. This would be done with used and unused clothes and the separated components would be reintroduced into the manufacturing cycle of recycled clothes.

The event explored how accelerator technologies could address environmental issues. It brought together 24 students of 14 different nationalities, with as many different backgrounds: physics and engineering, as well as environmental science,

communication and sociology. Three other projects were presented: studying pollen sterilisation of invasive plants; investigating innovative methods to recycle solar panels; and examining in-situ corrosion prevention of offshore wind turbines.
The next edition of the I.FAST-CBI project will take place in summer 2024 and will focus on the topic "Accelerators for Health". Applications will open in December 2023. Find out more on the I.FAST website.
For more examples of the impact on society of accelerator technologies and expertise, visit CERN's Contribute to society webpage (https://home.cern/about/what-we-do/our-impact).

Empowering change – new ambassadors at the CERN & Society Foundation

Get to know the Foundation's new ambassadors

From left to right: Professor Rolf-Dieter Heuer, Dame Anne Richards and Professor Peter Jenni. (Image: CERN)

The CERN & Society Foundation, whose purpose is to support and promote the dissemination, to the widest possible audience, of the benefits of the mission of CERN, through education and outreach, innovation and knowledge exchange, culture and art, complements CERN's goals with a philanthropic arm. This year, the Foundation is pleased to announce the appointment of three new official ambassadors: Rolf-Dieter Heuer, Anne Richards and Peter Jenni, joining William Hurley (known as Whurley), who has served as a CERN & Society Foundation ambassador since 2018. Ambassadors are nominated by the Foundation Board for a period of three years (renewable) and serve on a voluntary basis to support the outreach of the Foundation.
As Director-General of CERN (2009–2015), Professor Rolf-Dieter Heuer (DE) launched the concept of the CERN & Society Foundation to advocate collaboration and partnerships in support of CERN's mission. Following the conclusion of his term as Director-General, he joined the CERN & Society Foundation Board as a member for two full mandates, the maximum allowed, until 2022. Several of the programmes now promoted by the Foundation were established with his close involvement as Director-General, among them the Beamline for Schools competition and Arts@CERN.
Dame Anne Richards (UK) first connected with CERN when she was a summer student and research fellow in the 1980s and has remained engaged in support of the Laboratory since then. In 2014, she joined the CERN & Society Foundation Board as its first Chair, and guided the establishment and development of the Foundation until 2020.
Professor Peter Jenni (CH), a particle physicist, started his career at CERN in the 1970s and, among many other roles, was spokesperson for the ATLAS experiment until 2009. With Fabiola Gianotti, current Director-General of CERN, he launched the ATLAS PhD Grant Scheme, which has now evolved into the Non-Member State PhD Studentship Scheme. Peter served as a CERN & Society Foundation member and Deputy Chair from 2014 to 2020.
The CERN & Society Foundation Board is extremely pleased to benefit from the support and prestige of all the distinguished ambassadors and looks forward to working closely with them to spread CERN's spirit of scientific curiosity for the inspiration and benefit of society.

Computer Security: Avoiding salmonella in your code

Writing quality software is like preparing an amazing meal for your friends. Quality ingredients. Established utensils. A clean kitchen (at least initially). And regular tasting to avoid giving your friends a disappointment (or salmonella). The same thing applies to coding. Choosing a suitable programming language. Using established software and version management tools. Preparing clean and well-documented lines of code. And repeated scanning and testing to find blunders, flaws, weaknesses, bugs and vulnerabilities – digital salmonella, in other words – in plenty of time and long before the software makes it into production. CERN's IT department has two new tools that are just the thing to help you prepare a delicious software dinner for your friends: GitLab's "Static Application Security Testing" and "Secret Detection". Guaranteed salmonella-free.

Static Application Security Testing (SAST) is a pivotal component for securing your code. It is capable of examining the entire codebase in a quick and automatic manner as early as possible in the software development life cycle. With SAST, vulnerabilities can be found ahead of time in the development process. You just run SAST as another job within your regular pipeline build. Without halting your build process, areas for improvement, vulnerabilities and other kinds of digital salmonella are quickly identified and ready to be addressed by the cook-of-the-keyboard.

Similarly, scanning for secrets – another kind of digital salmonella – is another essential step. Secrets (like passwords, tokens, private keys and certificates) are the glue that bind together various application parts (like SaaS components, databases and cloud infrastructures). Such secrets are frequently hardcoded into source code since they are intended to be used programmatically. In fact, over 5 million secrets were found in public software repositories according to GitGuardian's 2021 State of Secrets Sprawl report, up 20% from the previous year, and not even including plaintext secrets contained in private repositories! So, to keep your secret a secret, to keep the Organization secure, and to keep digital salmonella out, Git's "Secret Detection" is another important tool to run during your build processes. It will make you aware of the use (and potential exposure!) of secrets, and allow you to get this fixed (see also our recommendations on how to keep secrets secret.

Both of these security tools, SAST and "Secret Detection", are already available with CERN's current GitLab Ultimate licence*. Details of how to employ them can be found on this dedicated webpage.

Once enabled and running, the results are directly visible in the "Vulnerability Report" of your project. While their use is currently on a voluntary basis – please opt in! –, we are planning to run these tools on a regular basis and provide you automagically with the result of our/that pipeline as of Q1/2024. And, cherry on the cake, we also provide you with a second level of security checks ("DAST – Dynamic Application Security Testing") as well as dedicated training courses. Have a look! As, after all, we don't want your friends (and CERN's software stack) getting salmonella!

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** We also hope to be able to tackle supply-chain problems when importing remote software packages, libraries, containers and virtual machines.*

The Computer Security team

New electronic motorway sticker available since 1 August 2023

Since 1 August 2023, people wishing to acquire a Swiss motorway sticker can choose between the following two formats:

1. self-adhesive sticker, to be attached directly to the vehicle's windscreen, which can be purchased in one of the usual outlets (post offices, petrol stations and garages, cantonal vehicle registration offices);
2. electronic sticker (e-sticker), which can be purchased on the "Via" portal of the Federal Office for Customs and Border Security (*Office fédéral de la douane et de la sécurité des frontières,* OFDF) (https://via.admin.ch/shop/dashboard).

The main difference between these two formats is that the self-adhesive sticker is associated with the vehicle and the e-sticker with the registration plate. The latter solution is useful for people who live in Switzerland and possess interchangeable plates (the same registration plate for several vehicles) and for those who buy a new vehicle during the year, as the e-sticker will then be allocated to that registration number.

In the event of a change of registration number due to a move to a different canton, theft or loss, the electronic sticker can be transferred to the new registration plate using the Via portal or by filling out an online form.

Vehicles registered in France are not eligible for the transfer of the electronic motorway sticker because their registration number is unique and unmodifiable until the vehicle is destroyed or exported. Nonetheless, if you purchase an e-sticker, you will not have to purchase a new one if your vehicle's windscreen is shattered.

Please note that the period of validity of the e-sticker is identical to that of the self-adhesive sticker, whatever the date of purchase (from 1 December of the previous year until 31 January of the following year). For example, the 2023 sticker is valid from 1 December 2022 until 31 January 2024, while the 2024 sticker, which can be purchased as of 1 December 2023, will be valid until 31 January 2025. The sticker costs 40 Swiss francs, whatever the format chosen.

Driving on a Swiss motorway or semi-motorway (« route nationale ») without a sticker is punishable by a fine of 200 Swiss francs plus an additional 40 Swiss francs for the sticker. In addition, it is forbidden to detach a motorway sticker from one vehicle and attach it to another, even if the vehicle belongs to the same owner or in the case of interchangeable plates.

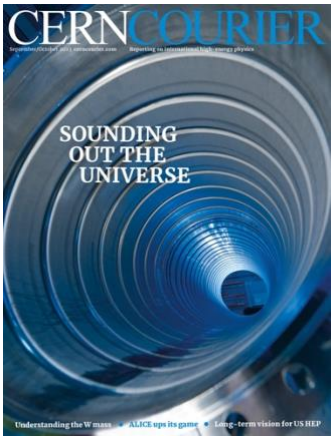
Useful links:

- Office fédéral de la douane et de la sécurité des frontières (OFDF – Federal Office for Customs and Border Security)(https://www.bazg.admin.ch/bazg/fr/home/infos-pour-particuliers/documents-de-voyage-et-redevances-routieres/vignette-autobahngebuehren/faq-vignette.html)
- https://via.admin.ch/shop/dashboard
- https://www.ch.ch/fr/circulation-et-vehicules/comportement-dans-la-circulation-routiere/vignette-autoroutiere/#

Host State Relations service
Tel.: 75152
Relations.secretariat@cern.ch
www.cern.ch/relations/

Announcements

The September/October issue of the CERN Courier is out



Links between particle physics and gravitational-wave science are strengthening, both in the theory realm and on the ground. A prime example is CERN's key role in the design of next-generation gravitational-wave observatories, in particular the vacuum tubes for the proposed Einstein Telescope in Europe (p45).

A second in-depth feature by CERN authors explores the potential of this and other gravitational-wave observatories to study high-energy processes in the early universe (p32). Among them are cosmological phase transitions, which are predicted to contribute to a stochastic gravitational-wave background. In late June, networks of radio telescopes around the world spotted tentative evidence for low-frequency waves consistent with such a background (p7).

Take a deep dive into the high-spec world of graphics processing units with the ALICE O 2 computing upgrade (p39), delve into a century of FCC physics (p20), survey the linear-collider marketplace (p23), zoom out on the vast landscape of accelerators in physics and industry (p19), and explore the long-term US vision for particle physics (p50).

This issue also takes a closer look at efforts to understand the wild variation in recent measurements of the W-boson mass (p27), the latest LHC results (p22), careers (p55), reviews (p52) and more.

Read the digital edition of this new issue on CDS (https://cds.cern.ch/record/2869155).

The heart of the matter

CERN joins forces with the HUG and other partners for a three-day cardiovascular health awareness campaign

29 September is World Heart Day, an occasion to raise awareness of cardiovascular diseases (CVDs) and how to prevent them. In this context, the CERN Medical Service will join forces with several partners for an awareness campaign on cardiovascular health, from 26 to 28 September.

As explained in the article A healthy lifestyle for a healthy heart, published in the June edition of the CHIS Bull', CVDs are a group of disorders of the heart and blood vessels, which include coronary heart disease, cerebrovascular disease (stroke) and rheumatic heart disease.

The objective of this interactive campaign is to raise awareness among the CERN community of CVDs and provide information and tools to prevent them.

It will address several themes – including diet, physical activity, stress management and first-aid – and will also include personalised advice from professionals for you to find out more about your heart health and risk factors. The Hôpitaux Universitaires de Genève (HUG) and the Save a Life Association will give talks on different topics around CVDs on Tuesday 26 September, from 12.15 to 2 p.m., and CERN psychologists will give two sessions on managing stress to improve your cardiovascular health on Wednesday 27 September from 1.30 p.m. All talks will be held in the IT auditorium and will be webcast and recorded.

The campaign will take place mainly in Restaurant 2, with some activities taking place in Restaurant

1. Talks will be held in the IT auditorium (31/3-004).
For the full programme, see: https://hse.cern/cvd

We hope that many of you will be able to take part in this event to learn about how to achieve optimal heart health!

CERN Medical Service

Restaurant 2 expands its opening hours from 18 September

As of Monday 18 September 2023, CERN Restaurant 2 (R2) will be open until 5:00 p.m. from Monday to Friday for the CERN community to enjoy its facilities after 3.00 p.m.. Thanks to this extended time range, R2 will also offer "anti-waste" operations. This initiative is part of the provider's continued efforts to tackle food waste.

With its updated opening hours, R2 will now offer its unsold items and short-expiring-date products with 50% discount from 2:30 p.m. onwards, in addition to its usual offer of catering, snacks and hot and cold drinks.
A valuable offer for your pocket and for the environment!

Ice creams on the Esplanade des Particules

To help deal with the hot weather and to brighten up our working days, the latest addition to the Esplanade of Particles is a "glacier des particules" ice-cream cart.
Located next to the automatic turnstile doors of building 33 (CERN's reception), the ice cream cart is open from Tuesday to Saturday from 12.30 p.m. to 7 p.m. for the delight of CERN personnel and visitors. The cart offers six to eight flavours, and the sorbets are vegan. One scoop is 4 CHF, two scoops are 6 CHF.
Depending on weather conditions, the glacier des particules should be there until October. Don't miss it! Go and enjoy their delicious ice creams.

"La nuit est belle 2023 !"

On the evening of Friday, 22 September, CERN will be participating in the 4th edition of *"La nuit est belle"* event, during which the street lighting of more than 150 communes in the local area will remain switched off.
This 4th edition will be dedicated to human beings and the night. Lighting influences our body and our habits: *"La nuit est belle 2023!"* questions two major topics: health and safety at night.
CERN will join this initiative by switching off the lights all evening and night, of the Globe, the *Esplanade des Particules*, Gates A, B, C and E, the roads and car parks on the Meyrin and Prévessin sites, and the SPS and LHC sites, as well as a public event organised by the CERN astronomy club.
If you are working at CERN, you can contribute by **switching off your computers, monitors and lights when you go home**. Please remember that switching off computers and lights is good practice in general to save energy and favour biodiversity

at night, read more: https://hse.cern/content/energy-management.

Cyclists and pedestrians – make sure that you can be seen in the dark! Car-drivers – stay alert! HSE recommends that you wear light-coloured clothing, preferably with reflectors, if you are out when it is dark:

- People wearing dark clothes will be seen by a car from a distance of about 25 metres
- People wearing light-coloured clothes will be seen from a distance of about 40 metres
- People wearing reflectors will be seen from a distance of about 125 metres

During the evening, many activities will be organised in the local area:

- Visit https://lanuitestbelle.org for more information and to register for activities
- Follow the event live on social media via the hashtag #lanuitestbelle

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Preparing for retirement: seminars for staff

Retirement marks the end of a person's professional career and the start of a new chapter in life. Research shows that this transition is easier for those who are well informed and prepared.

If you are a **staff member** and considering retirement in the next one or two years, we encourage you to participate in **two special seminars**, organised by Human Resources Department:

1. **Preparation for retirement**: a seminar organized jointly by ILO and UNOG once a year, for international civil servants from different international organizations in Geneva.
   The next seminar takes place virtually via Zoom from **13 to 30 Nov 2023** with 12 short sessions of 60' to 90'.
   The full programme is available for download from the Learning Hub.
   You can **enrol now** (https://lms.cern.ch/ekp/servlet/FORMAT1?CID=EKP000041244&LANGUAGE_TAG=en) – deadline 16 October.
2. **Leaving CERN**: a yearly information seminar at CERN, with presentations and Q&A sessions with internal experts.
   The next half-day seminar will take place on **12 Oct 2023** 14:00 - 17:35 CET in CERN Prévessin 774/R-013.
   You can **enrol now** (https://lms.cern.ch/ekp/servlet/FORMAT1?CID=EKP000040257&LANGUAGE_TAG=en).

Spouses and registered partners can also attend these seminars.

For more information, contact your.career@cern.ch.

HR department

The CERN Library will re-open soon! To celebrate, take part in a series of fun activities on 28 and 29 September 2023

The CERN Library team is organising a two-day event with many activities in building 52, 1st floor

The CERN Scientific Information Service and the SCE department are delighted to announce the inauguration of the Library on 28 September 2023, after one year of renovation. Come and visit our fully renovated and refurbished space – a light-flooded and environment-friendly reading room, with workplaces and a vast book collection – that has been designed for you!

To celebrate, we would like to invite the CERN community to join us for a two-day event on 28 and 29 September 2023. The opening ceremony will take place on 28 September at 10 a.m. It will be followed by two days of festivities. Besides visiting the new premises, you can take part in our activities:

- Treasure Hunt (registration required)
- Games (no registration required, just come to the Library!):
    - Challenge the librarian!
    - Hold your head high!
    - Guess the papers!
- Photo Challenge (register your photo)
- Music Concert

The complete programme, details about the activities and registrations are available on the event page (https://indico.cern.ch/event/1289266/timetable/?view=standard). Participate and have a chance to win a prize!

For any questions, please contact: library.desk@cern.ch.

CERN Library

Library - New books and e-books in August

The Library team adds new resources for the CERN community every day in its catalogue. Check the August 2023 additions here (https://catalogue.library.cern/search?q=_created%3A%5B2023-08-01%20TO%202023-08-31%5D%20AND%20publication_year%3A%5B2018%20TO%202023%5D&f=doctype%3ABOOK&f=doctype%3APROCEEDINGS&l=grid&order=asc&p=1&s=60&sort=bestmatch).

Find more books and e-books in the CERN Library Catalogue.

Please let us know if you cannot find the book you need via our request form.

Enjoy reading! For any question or suggestion, contact the Library: library.desk@cern.ch

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Join us in celebrating the tenth edition of the Beamline for Schools competition

The hybrid event is open to all and will showcase presentations from different perspectives of the competition, including current and former winning students

The tenth edition of the Beamline for Schools (BL4S) competition takes place this year, featuring winning teams from the Netherlands, Pakistan and the United States. The winning teams will stay at CERN or DESY from 14 to 28 September.

To celebrate the tenth edition, CERN is organising a hybrid webinar on 20 September from 3 p.m. to 5 p.m. This event will be attended by representatives from CERN and DESY, sponsors of the competition via the CERN & Society Foundation, the current and former winning students, team coaches, and support scientists who will give presentations. Each presenter will offer a unique perspective on the various aspects of the competition.

The event is open to everyone from the CERN Community and can be attended either in person or online. You can find the link to the event on the Indico page (https://indico.cern.ch/event/1315414/).

20 September – 3 p.m. to 5 p.m.

Webinar on Federated Learning on 28 September

A federated learning (FL) platform, called CAFEIN*, based on artificial-intelligence (AI) algorithms, was developed at CERN in order to ensure immense precision in the operation of the complex accelerator chain.

The key advantages of FL are:

- Privacy protection: Raw data never leaves the device, which protects user privacy and sensitive information.
- Efficiency: Federated learning can be more efficient than traditional centralised training, especially for large datasets or when dealing with data stored on edge devices.
- Decentralisation: It's well-suited to scenarios where data is distributed across many devices or locations, such as IoT devices, healthcare institutions and more.
- Adaptation: Federated learning can be used to adapt models to individual user preferences or local conditions while maintaining a global model's performance.

These special features make it useful in applications where data privacy is a top priority, such as in mobile devices, healthcare and more.

You are warmly invited to join this online webinar to find out more about CAFEIN and its applications in various domains, with a particular emphasis on healthcare through a new EU project (TRUSTroke)**. The speakers include:

- Stefano Savazzi (Consiglio Nazionale delle Ricerche), who will talk about FL theories and applications;
- Michele Carminati and Alessandro Redondi (Politecnico di Milano), who will cover the federated network, its security and its privacy;
- Luigi Serio and Diogo Reis Santos (CERN), who will explain and demonstrate the CAFEIN FL operating platform.

More information: https://indico.cern.ch/e/trustrokewebinar

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** The Computer-Aided deFEcts detection, Identification and classificatioN (CAFEIN) project has received support from the CERN Budget for knowledge transfer to medical applications through a grant awarded in 2019*

***The TRUSTroke project is funded by the European Union in the call HORIZON-HLTH-2022-STAYHLTH-01-two-stage, under grant agreement No-101080564*

KT Seminar on 29 September: How AI and a CERN federated learning platform can assist clinicians in the management of stroke patients

CERN's federated learning platform, CAFEIN*, which was originally designed to spot anomalies in the operation of the accelerator chain, can also be used in healthcare, specifically in the management of stroke patients.

Vall d'Hebron, a leading healthcare campus in Barcelona, CERN and eleven other partners from across Europe have joined forces to assist clinicians, caregivers and patients by creating AI algorithms using data confined to the hospital environment – the key feature of the CAFEIN platform. Read more about this new EU project, called TRUSTroke**, in this article (see p. 1).

You are warmly invited to attend this seminar and learn about this example of how CERN technologies can have societal impact and change our lives.

The seminar will be given by Luigi Serio (CERN) and Pietro Caliandro (Policlinico Gemelli), with an introduction by Mike Lamont, CERN's Director for Accelerators and Technology.

More information: https://indico.cern.ch/e/trustroke.

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Alumni event on 28 September: News from the Lab with CERN KT on Quantum

This "News from the lab" event will explore CERN's Quantum Technology Initiative (QTI), a roadmap and research programme in quantum technologies. In this talk, Benjamin Frisch from CERN's Knowledge Transfer Group will present CERN's QTI and how it creates a dialogue between the high-energy physics and quantum-tech communities.

28 September – 6 p.m.

Registration on the Alumni website (https://alumni.cern/events/120939).

Alumni event on 29 September: "Virtual company showroom" with Renishaw

Join representatives from Renishaw 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 a.m. on 29 September with a general presentation, which will be followed by a Q&A session – come armed with your questions!

Please register here (https://alumni.cern/events/122699) for the event to receive the zoom link.

29 September – 11 a.m.

Registration on the Alumni website (https://alumni.cern/events/122699).

Ombud's corner

Feeling beyond help

The World Health Organization (WHO) web site defines mental health as: "*a state of mental well-being that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their community*".

The site also lists - non-exhaustively - risks to mental health, also referred to as psychosocial risks:

- under-use of skills or being under-skilled for work
- excessive workloads or work pace, understaffing
- long, unsocial or inflexible hours
- lack of control over job design or workload
- unsafe or poor physical working conditions
- organizational culture that enables negative behaviours
- limited support from colleagues or authoritarian supervision
- violence, harassment or bullying
- discrimination and exclusion
- unclear job role
- under- or over-promotion
- job insecurity, inadequate pay, or poor investment in career development
- conflicting home/work demands.

I can associate these risks with the vast majority of issues that are raised by my visitors and could add:

- loss of purpose
- lack of appreciation
- lack of clear and fluid communication in change management.

Indeed, in 2022, one out of every 5 colleagues who asked to meet the Ombud reported mental health issues linked to their experience in the workplace. They would mention loss of sleep, loss of appetite, constant crying. They would ruminate about the problem there were facing and find themselves in a downward spiral of negative thoughts.

I am very grateful that they trusted me to discuss the situation that they were facing. At least, I could offer active listening and empathy. I also offered an external view of the situation, which helped them distance themselves from the situation. In some worrying cases, I also invited them to contact the CERN psychologists, who are available for consultation and can provide professional advice on mental health issues.

People who visit the Ombud's Office know that our conversation will be strictly confidential and will stay between the four walls of the office or the four virtual walls of my personal zoom room. They also trust the Ombud to stay totally neutral and impartial.

Most of the time my visitors know what they should do about a problem but may not be confident enough to decide how to go about it. Exchanging on possibilities – the Ombuds does not influence people but helps them to get their ideas and plans in order – allows the visitor to take their final decision.

The **Work Well Feel Well** project, which was initiated in 2017, will launch a new prevention campaign this autumn**:** "**Efficiency and caring at work**".

In particular, they have invited Catherine Vasey, psychologist and burn-out specialist, to give a seminar on 6 October on the subject of the prevention of burn-out in a particularly demanding professional context. I highly recommend you register for the seminar, which you can do here (https://indico.cern.ch/event/1302707/).

We all have ups and downs in our personal and professional lives, with downs sometimes very severe as they can lead to overwhelming stress, burn-out and/or depression. It is very important to seek support as early as possible and the Ombud is there to help you.

I remember being on a communication course in my early years at CERN, it must have been in the 90s. I had an interesting discussion with a former colleague (and later CERN Ombud, Sudeshna Datta Cockerill) who told me "*It is when you think that you are beyond help, that you* ***have*** *to find support*".

I would also like to borrow from another former CERN Ombud, Vincent Vuillemin, the conclusion of his article, which is still very valid today:

"Never believe that your case is too trivial, just come to the Office. Most people simply want to bring their concerns to the Ombud, be heard with empathy, and be comforted that there are ways they can take to handle their situation themselves. The Ombud will also direct you to other Services where you can get professional help if you need it. Do not stay isolated. Build a network of support before it is too late."

Laure Esteveny

I would like to hear your reactions and suggestions – join the CERN Ombud Mattermost team at https://mattermost.web.cern.ch/cern-ombud/.

All information on the role of the CERN Ombud and how to contact her may be found at https://ombud.web.cern.ch/