CERN Bulletin

Issue No. 29-30-31/2023 – 20 July 2023
http://home.cern/cern-people

CERN Science Gateway: architecture at the service of knowledge

Science Gateway, the most recent of CERN's iconic buildings, is the latest in a long line of innovative architectural concepts aiming to bring different communities together around scientific research

The Science Gateway building in July 2023. (Image: CERN)

Throughout CERN's almost 70-year history, architecture has been placed at the service of science through iconic structures built on the Laboratory's sites. As the Science Gateway building – designed by renowned Italian architect Renzo Piano – is nearing completion, we explore how these grand architectural projects have shaped the Organization since its early days.

Building 60, on the Meyrin site, is currently undergoing renovations to make it fit for the 21st century while respecting the architect's vision (Image: CERN)

The original CERN complex, dating from the 1950s and centred around its Main Building, established the Laboratory's strong architectural identity. The Zurich-based architects in charge of the project, Rudolf and Peter Steiger, sought primarily to tie in with the "international Geneva" architectural movement that, in the aftermath of the Second World War, was injecting a spirit of modernity and renewal into institutions such as the World Health Organization and the International Labour Office by means of monumental, utilitarian and sculptural structures. We find this monumental character in CERN's Main Building and Building 60, as well as in the experimental halls and neighbouring buildings that the architects sought to harmonise, all linked by an architectural unity emphasising exposed reinforced concrete.

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In short, the architecture of the original complex reflected the coherence of the Laboratory's project, in which the services and communities revolved around a unified, communal space.

Over the years, CERN has added other iconic buildings, such as Building 40 with its vast central atrium, completed in 1996, and its extension, Building 42, completed in 2011 and now the seat of the CERN Directorate. Both of these buildings were designed by architect Jacques Perret. In addition, the Globe of Science and Innovation, initially built for the Swiss National Exhibition in 2002 and presented to CERN to mark its 50th anniversary, has since become a symbol of the Organization and the surrounding area.

More recently, the Prévessin site has welcomed some ambitious and environmentally minded architectural projects, such as Building 774, designed by architects Octavio Mestre and Francesco Soppelsa. Inaugurated in 2015, its innovative design includes a façade covered with solar panels based on CERN technology. It sits opposite the new data centre, which will use cutting-edge cooling technologies and recover the thermal energy generated by the computing infrastructure to heat other buildings on the site.

But all eyes are now on Science Gateway, whose inauguration is due to take place in October. Patrick Geeraert, Science Gateway Project Leader, recalls how this vast undertaking began: "When Renzo Piano presented his model to us in 2018, in his Genoa offices, it turned all our plans upside down. The project was as magnificent as it was ambitious." The proposal would go on to take the form of a structure divided into three pavilions and two imposing tubes connected by a suspended walkway.

The strong symbolism of the two tubes suspended over the road is unmissable: Renzo Piano intended them to mirror the LHC tunnel, located 100 metres below. They will immerse visitors in the world of particle accelerators before they even enter the building. In another nod to the universe of science, the silhouette of Science Gateway seen from above recalls that of a space station that has landed in a forest. With 400 trees planted especially, this forest is another key feature of the project, underlining the close links between science and nature. Lastly, the materials chosen and the overall aesthetic of the building, with its raw forms and exposed concrete, celebrate – rather than try to conceal – CERN's industrial character.

Five years and one pandemic later, with the support of the ICM and Cimolai consortia, the dream has become a reality and CERN is preparing to open even more to the world thanks to its new centre. Just a few months away from the opening, Patrick Geeraert has plenty to be happy about: "A few years ago, we couldn't have dreamed of building such a structure in such a short time and without impinging on the CERN Budget. The project has been financed entirely by donations, and I'd like to thank our sponsors once again, as well as all the CERN teams who have helped to make Science Gateway a reality."

Without a shadow of a doubt, Science Gateway will be much more than just an exhibition centre; it will be a hub where science is brought to life, the scientific community is welcomed and the wellspring of ideas that has characterised CERN for almost 70 years will be nurtured. Grand architectural projects marked the Organization's early days and will help usher in its future.

Thomas Hortala

Accelerator Report: A quench of an LHC inner triplet magnet causes a small leak with major consequences

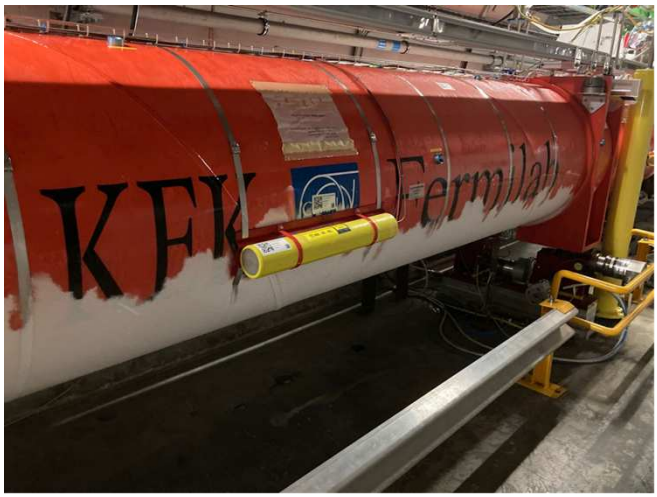
At 1.00 a.m. + 17 seconds on Monday, 17 July, the LHC beams were dumped after only 9 minutes in collision due to a radiofrequency interlock caused by an electrical perturbation. Approximately 300 milliseconds after the beams were cleanly dumped, several superconducting magnets around the LHC quenched – i.e. they lost their superconducting state. Among these magnets were the inner triplet magnets located to the left of Point 8 (LHCb), which play a crucial role in focusing the beams for the LHCb experiment.

While this sequence of events may not happen very often during beam operation, it is not exceptional for the LHC, as occasional quenches of some superconducting magnets are to be expected.

In this particular case, the electrical perturbation caused the quench protection system (QPS) to trigger the quench heaters of the magnets concerned. These quench heaters consist of an electrical resistor embedded in the magnet coils; they are designed to heat up quickly when a localised quench occurs somewhere in the magnet, in order to effectively bring the whole magnet out of the superconducting state in a controlled and homogenous manner. During such a quench, the liquid helium in the magnet warms up and turns into a gas that is recovered by the cryogenic system to be re-liquified, ready to cool down the magnets again.

Despite this being a normal and expected behaviour, the mechanical stresses involved in this process are significant and, in very rare cases, can lead to damage. Unfortunately, in the case of the inner triplet magnet located to the left of Point 8, a small leak has appeared between the cryogenic circuit, which contains the liquid helium, and the insulation vacuum that separates the cold magnet from the warm outer vessel, known as the cryostat. This vacuum barrier is crucial for preventing heat transfer from the surrounding LHC tunnel to the interior of the cryostat (this is similar to the functioning of a thermos flask). As a result of the leak, this insulation was lost: the insulation vacuum filled with helium gas, cooling down the cryostat and causing condensation to form and freeze on the outside.

As I write, investigations are ongoing to identify the source of the leak, to allow a repair strategy to be elaborated. Nevertheless, it is clear that an intervention with the inner triplet magnet at room temperature will be required. This incident will probably have a great impact on the LHC schedule, with machine operation unlikely to resume for at least several weeks.

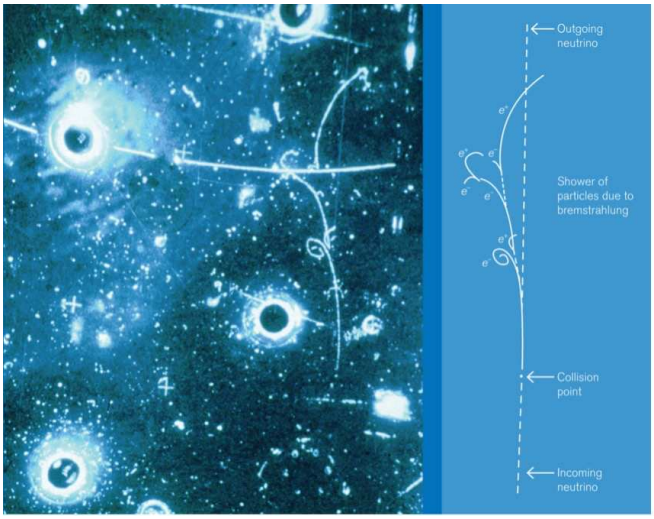


The cryostat containing the inner triplet magnets. The tiny amount of very cold helium that replaced the insulation vacuum cooled down the cryostat, causing condensation of the tunnel air on the cryostat, which then froze. Several hours later, the thin layer of ice had melted again as the cryostat returned to room temperature. (Image: CERN)

Rende Steerenberg

50 years of giant electroweak discoveries

On 19 July 1973, the Gargamelle bubble chamber at CERN revealed the existence of weak neutral currents and put the nascent Standard Model of particle physics on solid ground



The first leptonic neutral current event spotted with Gargamelle. It shows an incoming neutrino (not visible) arriving from below where it then interacts with an electron (visible track). The interaction radiates photons and then produces electron–positron pairs. (Credit: CERN-EX-60100-1/ Kurt Riesselmann)

Half a century ago, a series of tiny tracks in a bubble chamber at CERN changed the course of particle physics. The observation of "weak neutral currents", announced on 19 July 1973 by Paul Musset of the Gargamelle collaboration, suggested that the electromagnetic and weak forces are facets of a more fundamental electroweak interaction that ruled in the early Universe. Exploring this new sector of nature has been a core business of CERN ever since, leading to the discovery of the W and Z bosons in 1983 and culminating with the discovery of the Higgs boson in 2012.

The weak force is one of the four fundamental forces of nature, responsible for crucial processes such as radioactive beta decay. Whereas the electromagnetic force was well understood as the result of neutral photons being exchanged between charged particles, the weak interaction was harder to cast in the language of quantum theory. In the 1960s, theorists posited that the weak interaction was mediated by massive versions of the photon: the charged W boson and the neutral Z boson, both inextricably tied up with the photon of electromagnetism. The W boson enabled weak interactions that involved a rearrangement of electrical charge, while the Z boson was how uncharged particles interacted via the weak force. While the former were already known to occur, the latter had never been seen before.

As physicists mastered the art of firing intense beams of neutrinos into detectors to study fundamental interactions, searches for neutral currents became possible. By the late 1960s André Lagarrigue of LAL Orsay had proposed the world's biggest bubble chamber, Gargamelle, named after a fictional giantess. The chamber was built by the École Polytechnique Paris in 1968 and assembled at one of the beamlines of CERN's Proton Synchrotron. Data taking started in 1970, with first results coming in shortly after. Reflecting the focus of experimentalists at the time, the search for neutral currents was placed only eighth in Gargamelle's top-ten physics goals.

Picking out experimental evidence for neutral currents from among numerous similar-looking events was not easy, especially with the technology of the time. Researchers needed to see both "leptonic" events (whereby a neutrino interacted with an electron in the dense gas Gargamelle was filled with) and "hadronic" events (whereby a neutrino was scattered from a proton or neutron). "I remember spending the evenings with my colleagues scanning the films on special projectors, which allowed us to observe the eight views of the chamber," recalls Gargamelle member Donatella Cavalli from the University of Milan, who was a PhD student at the time. "When the first leptonic event was found in December 1972, we were convinced that neutral currents existed."

Further data would reveal candidate hadronic neutral-current events, but it took time for the community to be convinced. Initially, the independent Harvard–Pennsylvania–Wisconsin–Fermilab experiment in the US confirmed Gargamelle's findings, but when they changed their experimental set-up, the tracks vanished. Only in 1974, after further analysis by both collaborations, was the existence of neutral

currents universally accepted – leading to the award of the 1979 Nobel Prize in Physics to electroweak architects Sheldon Glashow, Abdus Salam and Steven Weinberg.
Gargamelle is now an exhibit in CERN's Van Hove Square, but physicists are still pursuing the path it opened . In providing the first evidence for electroweak theory, Gargamelle's results guided CERN to convert the Super Proton Synchrotron into a proton–antiproton collider powerful enough to enable the UA1 and UA2 collaborations to discover the W and Z bosons directly – a feat recognised by the award of the 1984 Nobel Prize in Physics to Carlo Rubbia and Simon van der Meer of CERN. During the 1990s, precision measurements of the W and Z bosons at the Large Electron–Positron collider confirmed important "quantum corrections" to electroweak theory (which, together with the theory of the strong force, quantum chromodynamics, makes up the Standard Model of particle physics). This guided physicists towards the discovery of the final piece of the electroweak jigsaw – the Higgs boson – at the Large Hadron Collider (LHC) in 2012, which led theorists François Englert and Peter Higgs to be awarded the 2013 Nobel Prize in Physics.
But the journey does not end there. As the LHC's ATLAS and CMS experiments continue to probe the Higgs boson and other mysterious sectors of the Standard Model at increasing levels of precision, physicists are investigating the feasibility of a successor collider at CERN – the proposed Future Circular Collider – that would go much further, opening the next chapter in electroweak exploration.

Read more in the *CERN Courier*:

- CERN's neutrino odyssey (https://cerncourier.com/a/cerns-neutrino-odyssey/)
- The higgs after LHC (https://home.cern/news/news/physics/%C2%A0%C2%A0https://cerncourier.com/a/the-higgs-after-lhc/)

A scientific symposium marking 50 years of neutral currents and 40 years of the W and Z bosons will take place at CERN on 31 October 2023 in the Science Gateway Auditorium.

ALICE shines light into the nucleus to probe its structure

New ALICE results shed light on the nature of gluonic matter at the LHC

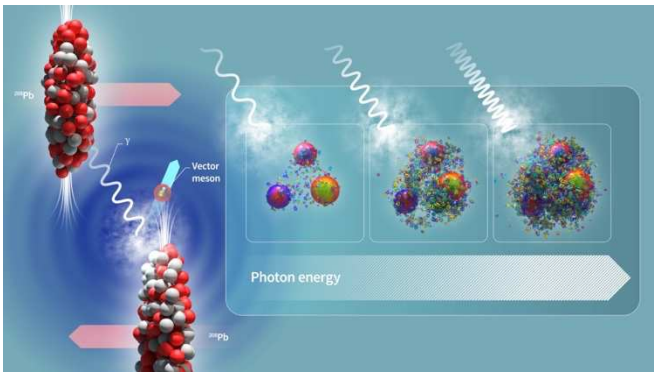


Illustration of an ultra-peripheral collision where the two lead ion beams at the LHC pass by close to each other without colliding. Photons emitted from one beam strike the other, producing electromagnetic interactions. The structure of the gluonic matter in the nucleus gets further exposed when probed by higher energy photons. (Image: CERN)

In the Large Hadron Collider, proton and lead beams travel close to the speed of light. They carry a strong electromagnetic field that acts like a flux of photons as the beam moves through the accelerator. When the two beams at the LHC pass by close to each other without colliding, one of the beams may emit a photon of very high energy that strikes the other beam. This can result in photon—nucleus, photon—proton, and even photon—photon collisions. The ALICE collaboration studies these collisions to investigate protons and the inner structure of nuclei, and has recently released new results on this topic at the LHCP 2023 conference.
Photons are ideal tools to study the interior of nuclei. Usually when a photon collides with a nucleus, two gluons (force carriers of the strong interaction) are exchanged, which results in the production of a quark-antiquark pair. Researchers further distinguish two different classes of these collisions: when a photon interacts with the whole

nucleus (a coherent collision), and when a photon interacts with a single nucleon inside the nucleus (an incoherent collision).

Inside nuclei, scientists look for high numbers of gluons, which indicate high levels of gluon density. Theoretical models suggest that the gluon density inside nuclei increases when they approach the speed of light. If the density increases enough, the nucleus will become saturated with gluonic matter, meaning that the number of gluons in the nucleus cannot increase any further. Directly probing gluonic saturated matter is one of the main outstanding challenges in the field of strong interactions, and observing it could lead to further insight into the inner structure of protons and nuclei.

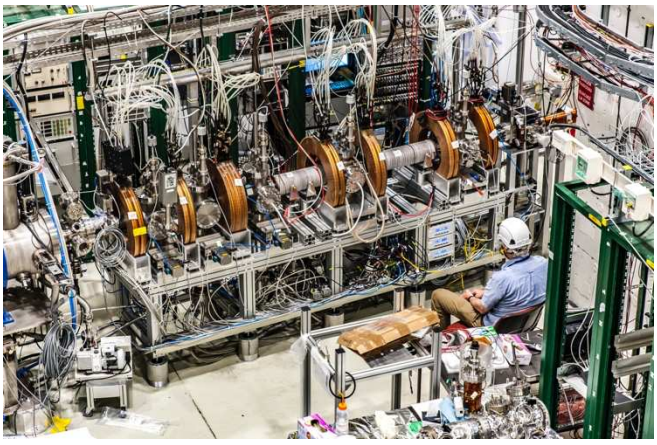
If a charm quark-antiquark pair is produced in a photon—nucleus collision, this is known as J/ψ meson production. Scientists study how coherent J/ψ production varies with photon energy in order to look for gluon saturation effects. As the photon energy increases, it becomes easier and easier to "see" the gluonic matter inside the nuclei. The new ALICE results on J/ψ production using LHC Run 2 data cover a larger momentum range than previous measurements from Run 1, and are in line with expectations of gluon-saturation models. Incoherent collisions offer the opportunity to study geometrical configurations of the quantum fluctuations in the internal structure of the proton. The ALICE collaboration achieves this by studying the distribution of momentum that is transferred to the J/ψ meson. In a new study, the collaboration has been able to show that this momentum transfer can only be described when areas of saturated gluonic matter, called gluonic hotspots, are introduced into the models.

The ALICE collaboration will continue to investigate these phenomena in LHC Runs 3 and 4, where high-precision measurements with larger data samples will provide more powerful tools to better understand the role of saturation and gluonic hotspots.

ALICE collaboration

GBAR joins the anticlub

The GBAR experiment at CERN has just joined the very select club of experiments that have succeeded in synthesising antihydrogen atoms



The GBAR experiment in the Antiproton Decelerator hall. (Image: CERN)

The aim of the GBAR experiment at CERN is to measure the acceleration of an antihydrogen atom – the simplest form of atomic antimatter – in Earth's gravitational field, and to compare it with that of the normal hydrogen atom. Such a comparison is a crucial test of Einstein's equivalence principle, which states that the trajectory of a particle is independent of its composition and internal structure when it is only subjected to gravitational forces.

But producing and slowing down an antiatom enough to see it in free fall is no mean feat. GBAR's approach is to first produce an antihydrogen atom and then turn it into a positive ion (the antimatter equivalent of an H^- ion). Then the ion can be slowed down using quantum-optical techniques. Finally, the ion is neutralised for free-fall measurement. In a new paper, the GBAR collaboration reports the successful production of its first antiatoms.

To achieve this, the team has developed a complex protocol in which antihydrogen atoms are

assembled from antiprotons produced by the Antiproton Decelerator (AD) and positrons produced in GBAR. The AD's 5.3-MeV antiprotons are decelerated and cooled in the ELENA ring and a packet of a few million 100-keV antiprotons is sent to GBAR every two minutes. In GBAR, a device called a pulsed drift tube further decelerates this packet to an adjustable energy of a few keV. In parallel, in another part of GBAR, a linear particle accelerator sends 9-MeV electrons onto a tungsten target, producing positrons, which are accumulated in a series of electromagnetic traps. Just before the antiproton packet arrives, the positrons are sent to a layer of nanoporous silica, from which about one in five positrons emerges as a positronium atom (the bound state of a positron and an electron). When the antiproton packet crosses the resulting cloud of positronium atoms, a charge exchange can take place, with the positronium giving up its positron to the antiproton, forming antihydrogen.

At the end of 2022, during an operation that lasted several days, the GBAR collaboration detected some 20 antihydrogen atoms produced in this way, validating this "in-flight" production method for the first time.

After this essential first step, the collaboration will now improve the production of antihydrogen atoms. This will enable precision measurements to be made on the antihydrogens themselves, in particular a measurement of an energy gap between two specific atomic levels, known as the Lamb shift. This measurement will give a more precise value of the radius of the antiproton. This will be followed by the production of positive antihydrogen ions, and finally by the implementation of the laser systems for cooling and neutralising these ions in order to finally observe the free fall of an antihydrogen atom.

GBAR is not the first experiment to produce antihydrogen: in 1995, an experiment at CERN's LEAR facility produced nine antiatoms, but at an energy too high for any measurement to be made. Following this early success, CERN's Antiproton Accumulator (used for the discovery of the W and Z bosons in 1983) was repurposed as a decelerator, becoming the AD, which is unique worldwide in providing low-energy (5-MeV) antiprotons to antimatter experiments. After the demonstration of holding antiprotons by the ATRAP and ATHENA experiments, ALPHA, a successor of ATHENA, was the first experiment to merge trapped antiprotons and positrons and to trap the resulting antihydrogen atoms. Since then, ATRAP and ASACUSA have also achieved these two milestones, and AEgIS has produced pulses of antiatoms. GBAR now joins this elite club, having produced 6-keV antihydrogen atoms in flight.

GBAR is also not alone in its aim of testing Einstein’s equivalence principle with atomic antimatter. ALPHA and AEgIS are also working towards this goal using other approaches.

Preparing for a quantum leap: researchers chart future for use of quantum computing in particle physics

Experts from CERN, DESY, IBM Quantum and others publish a white paper identifying activities in particle physics that could benefit from the application of quantum-computing technologies

Last week, researchers published an important white paper identifying activities in particle physics where burgeoning quantum-computing technologies could be applied. The paper, authored by experts from CERN, DESY, IBM Quantum and over 30 other organisations, is now available on ArXiv.

With quantum-computing technologies rapidly improving, the paper sets out where they could be applied within particle physics in order to help tackle computing challenges related not only to the Large Hadron Collider’s ambitious upgrade programme, but also to other colliders and low-energy experiments worldwide.

The paper was produced by a working group set up at the first-of-its-kind “QT4HEP” conference, held at CERN last November. Over the last eight months, the 46 members of this working group have worked hard to identify areas where

quantum-computing technologies could provide a significant boon.

The areas identified relate to both theoretical and experimental particle physics. The paper then maps these areas to "problem formulations" in quantum computing. This is an important step in ensuring that the particle physics community is well positioned to benefit from the massive potential of breakthrough new quantum computers when they come online.

On 1–4 November 2022, the first International Conference on Quantum Technologies for High-Energy Physics (QT4HEP) was held at CERN. (Image: CERN)

"Quantum computing is very promising, but not every problem in particle physics is suited to this mode of computing," says Alberto Di Meglio, head of the CERN Quantum Technology Initiative (CERN QTI) and one of the paper's lead authors, alongside DESY's Karl Jansen and IBM Quantum's Ivano Tavernelli. "It's important to ensure that we are ready and that we can accurately identify the areas where these technologies have the potential to be most useful for our community."

As far as theoretical particle physics is concerned, the authors have identified promising areas related to evolution of the quantum states, lattice-gauge theory, neutrino oscillations and quantum field theories in general. The applications considered include quantum dynamics, hybrid quantum/classical algorithms for static problems in lattice gauge theory, optimisation and classification.

On the experimental side, the authors have identified areas related to jet and track reconstruction, extraction of rare signals, for-and-beyond Standard Model problems, parton showers and experiment simulation. These are then mapped to classification, regression, optimisation and generation problems.

Members of the working group behind this paper will now begin the process of selecting specific use cases from the activities listed in the paper to be taken forward through CERN's and DESY's participation in the IBM Quantum Network, and through collaboration with IBM Quantum, under its "100x100 Challenge". IBM Quantum is long-standing collaborator of CERN QTI and the Center for Quantum Technologies and Applications (CQTA) at DESY.

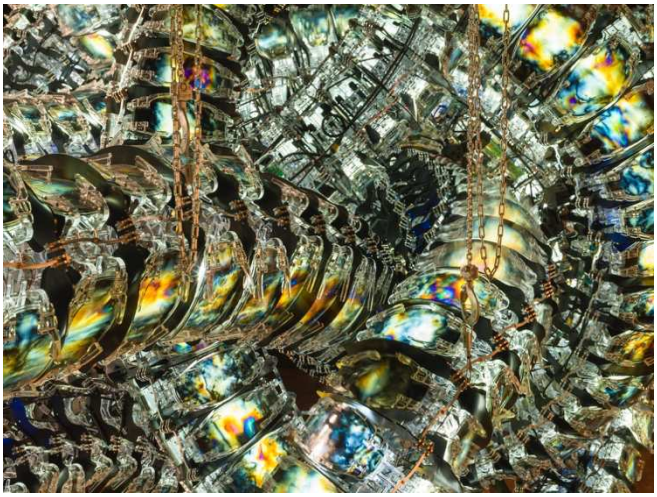
IBM's 100x100 Challenge will see the company provide a tool capable of calculating unbiased observables of circuits with 100 qubits and depth-100 gate operations in 2024. This will offer an important testbed for taking forward promising selected use cases from both particle physics and other research fields.

The working group will meet again at CERN for a special workshop on 16 and 17 November, immediately before the Quantum Techniques in Machine Learning conference is held at the Laboratory from 19 to 24 November.)

Andrew Purcell

Arts at CERN collaborates with Science Gallery Melbourne and the ARC Centre for the exhibition “Dark Matters”

Opening on 5 August, “Dark Matters” will bring artworks from Arts at CERN programmes to Australian audiences for the first time



Yunchul Kim, Chroma V, 2022. (Photo by Roman März)

Arts at CERN has joined forces with Science Gallery Melbourne and the ARC Centre of Excellence for Dark Matter Particle Physics to present Dark Matters, an exhibition that seeks to explore the fundamental essence of life and the Universe and to question how their mysteries continue to elude us. For over a decade, Arts at CERN has been actively developing international collaborations with leading scientific laboratories and cultural institutions to foster a global network of art and science. Through Dark Matters, Arts at CERN extends this commitment by igniting dialogues between artists and experts from the ARC Centre of Excellence for Dark Matter Particle Physics, Australia’s leading dark matter research centre.

In 2017, Arts at CERN launched its exhibitions programme with the aim of engaging with audiences who are interested in art and fundamental science and eager to connect with CERN’s research. Now, Dark Matters brings some of the remarkable creations that have emerged from the work and research of the artists-in-residence to connect with and inspire audiences across Melbourne.

Physicists estimate that we can see and interact with only 5% of the mass of the Universe; the rest remains little known. About 85% of this unseen mass is attributed to dark matter, which is particularly challenging to study because it does not visibly interact with light. As artists and scientists continue the ultimate quest to understand it, its elusive nature mirrors the limitations of our cognitive experience. Dark Matters poses the question of whether searching for this mysterious substance could lead us to imagine new possibilities for life, our relationship with non-humans, and creative technologies that enable us to access unfathomable environments.

Several artworks in the exhibition have been drawn from Arts at CERN’s residency programmes. South Korean music producer and artist Yunchul Kim presents Chroma V, a giant 50-metre-long sculpture that folds in on itself in an intricate knot. Made of metal and materials derived from techniques Kim explored in collaboration with material scientists, the installation detects subatomic particles and comes to life as it reacts to invisible forces. 2016 Collide awardee Kim will also premiere a new art commission in an upcoming exhibition at the CERN Science Gateway from October.

In the project Scientific Dreaming, British artist Suzanne Treister carried out a series of writing workshops with scientists from CERN and the University of Melbourne with the aim of opening their unconscious imaginations. Through interviews and exercises, the scientists wrote science fiction stories that envisage hopeful futures based on hypothetical scientific breakthroughs, while exposing the potential risks associated with these technological advances. The stories, as well as narrative plot diagrams by the artist, will be part of the exhibition.

Dark Matters will also feature the work of Swiss artist Alan Bogana, Chilean artist Patricia Domínguez, Lithuanian designer Julijonas Urbonas and British artist duo Semiconductor among other local and international artists.

Co-curated by Mónica Bello, Head of Arts at CERN, Tilly Boleyn, Head of Curatorial at Science Gallery Melbourne, and a panel of young people and academic experts, Dark Matters will consider how dark matter changes how we think about

ourselves, on both an individual level and a universal scale.

Ana Prendes

ALICE honours its PhD thesis award winners

ALICE Thesis Award winners pose with their awards. From left to right: Marco van Leeuwen (ALICE Spokesperson), Lucas Anne Vermunt, Marielle Chartier (Chair of the ALICE collaboration board), Ralf Averbeck (Chair of the Thesis Award committee), and Rita Sadek. (Image: CERN)

On 12 July 2023, the ALICE collaboration celebrated its PhD thesis award winners in a ceremony organised as part of the ALICE collaboration meeting at CERN. Since 2008, ALICE has recognised the most outstanding PhD theses in the fields of physics and instrumentation based on the excellence of the results obtained, the quality of the thesis manuscript, and the importance of the contribution to the collaboration.

The quality of all 21 theses submitted for the award this year has been excellent. After reviewing all the theses, the ALICE Thesis Award committee unanimously decided to honour two winners:

- Rita Sadek of Laboratoire Subatech, France for her thesis on “MFT commissioning and preparation for Run 3 data analysis with ALICE (LHC, CERN)”. (https://cds.cern.ch/record/2851658?ln=en) Rita is now a PostDoc with the LHCb collaboration at LLR Palaiseau.
- Lucas Anne Vermunt of Utrecht University, The Netherlands, for his thesis on “Hadronisation of heavy quarks - Production measurements of heavy-flavour hadrons from small to large collision systems” (https://cds.cern.ch/record/2810650). Lucas is now a PostDoc with ALICE at GSI Darmstadt.

Both winners received congratulations by the ALICE Spokesperson, Marco van Leeuwen, the Collaboration Board Chair, Marielle Chartier, and the Chair of the Thesis Award committee, Ralf Averbeck. Marco and Marielle handed over the award certificates and prizes to Rita and Luuk, who presented their thesis works in flash talks to the collaboration.

Further details on the ALICE Collaboration website (https://alice-collaboration.web.cern.ch/ALICE_Thesis_Award).

ALICE collaboration

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92 companies from across CERN Member and Associate Member States take part in CERN's thematic forum on civil engineering

CERN opened its doors to a variety of companies for the first CERN Civil Engineering Business Forum, ushering in CERN's new industry-specific networking strategy

On 24 and 25 May, CERN held its first Civil Engineering Business Forum. This industry-specific event was launched as part of the Laboratory's new approach to engaging with a variety of businesses, focused on a specific domain, from Member and Associate Member States. The new format allows for better business alignment and for greater interaction between CERN's suppliers, experts and procurement officers.

The forum was held in hybrid format, allowing a range of companies across the spectrum of civil engineering and construction to discover CERN's site and civil engineering plans and practices. The event saw broad participation from 92 companies representing 12 Member and Associate Member States, with over 50% of attendees coming on site. At least 50 one-to-one in-person meetings between companies and CERN representatives took place.

"I was delighted to see the enthusiastic interactions during the event. The fact that it was focused on a specific theme allowed all involved – potential suppliers, CERN technical experts and procurement officers – to have meaningful conversations about our civil engineering needs and how industry can be involved," says Luz Anastasia Lopez, Leader of CERN's Site and Civil Engineering Project Portfolio Management group.

The primary objectives of this new type of event are to:

Assist industry from all Member and Associate Member States in aligning with CERN's business needs and developing opportunities for collaboration.

Optimise and facilitate crucial interactions between suppliers and CERN's technical teams in a structured and targeted manner.

Increase competition by sourcing new suppliers.

Foster technological awareness and gather early feedback on industry capabilities and interest in specific projects.

Facilitate connections among suppliers to encourage the formation of consortia and the development of subcontractor networks.

CERN's Procurement group has also introduced market survey conferences, providing an avenue for relevant companies from Member and Associate Member States to learn about upcoming projects and calls for tender. The inaugural virtual conference, which took place in January 2023, focused on the purchase of cables for the High-Luminosity Large Hadron Collider (HL-LHC). The event made it possible to identify new suppliers, as well as to gather valuable feedback from the participating companies on specific technical considerations.

The successful execution of these events sets the stage for future industry engagement techniques, ensuring the continued growth and development of cutting-edge scientific research at CERN.

Marzena Lapka & Lisa Bellini-Devictor

An evening dedicated to neutrinos in Prévessin-Moëns

On Saturday, 8 July 2023, the inhabitants of Prévessin-Moëns had the opportunity to visit a unique CERN facility, the Neutrino Platform

One of the groups of visitors during the tour of the Neutrino Platform. (Image: CERN)

CERN, the Prévessin-Moëns local authorities and the village's municipal library joined forces to enable local residents to find out more about what goes on inside the Laboratory, with a particular focus on neutrinos.

Neutrinos are invisible particles, almost devoid of mass, which pass through matter like ghosts and behave unexpectedly at the quantum level. Their identity-shifting ability could help answer some of the great mysteries surrounding the origins of the Universe.

The evening kicked off with a screening at the Prévessin-Moëns municipal library of the film Ghost Particle, directed by Geneva Guérin. This scientific documentary explores the research going on worldwide to trace the origins of the Universe by studying its tiniest components, neutrinos, in some of the biggest experiments in existence.

The film was followed by a tour of the Prévessin site guided by CERN scientists. The visitors got a chance to visit the CERN Control Centre and the Neutrino Platform, a facility where the international community of neutrino specialists is developing the next generation of neutrino detectors.

The platform, which is located in the commune of Prévessin-Moëns, is CERN's main contribution to the DUNE experiment, a globally coordinated neutrino programme.

To find out more about this programme, check out the livestream video from the CERN Neutrino Platform, the Fermi National Accelerator Laboratory and the Sanford Underground Research Facility: https://videos.cern.ch/record/2298268.

For more information about the CERN Neutrino Platform, visit: https://home.cern/science/experiments/cern-neutrino-platform.

Computer Security: Fighting spam – the Boss Level

When it comes to protecting mailboxes against unwanted, unsolicited or even malicious emails, spam filtering is the first line of defence. And spam filtering is, while being a permanent fight against the windmill à la Don Quixote or against boulders and gravity à la Sisyphus, reasonably easy: you just need to have the right patterns of wrong emails to filter them out. The real challenge comes afterwards: identifying emails with malicious content hidden behinds links, URLs or within attachments – the malware detection and detonation part. Let's enter the Boss Level (like in any great movie or video game).

Actually, it's easy to complain about spam filtering when receiving emails which are obviously spam, full of typos, of no relevance or simply and plainly dumb and stupid. On the other hand, training the spam filter is complicated and complex, in particular in an Organization like CERN where emails come from all corners of the planet, are written and read in all languages of the world, and are answered day and night. It's even more complicated given that CERN allows personal use of the @cern.ch email address, meaning that it receives not only professional and work-related emails but also personal exchanges, private invoices, advertising and newsletters, some

directly, some forwarded from external mail hosting services like Gmail or from your institute's mail system. Finding the right balance between true spam emails to be rejected and those where some doubt remains is difficult, and as the CERN mail service prefers to be transparent, in case of doubt, emails are delivered either to your junk folder or withheld in the spam system's quarantine. But before delivery, there's one more step. Here comes the Superboss.

Evil attackers are permanently out to trick you. To convince you to click on that one malicious link, to open that one malicious attachment. One click and your password might be at risk, your computer infected, or your work or private life in peril. Ideally, such emails won't ever make it into your mailbox thanks to our sophisticated "email detonation" appliances. For each suspicious email, these appliances spawn up virtual machines with different operating system flavours (Windows 10, Windows 11, etc.), open the suspicious email and simulate user interactions – clicking, opening attachments, mouse movements. You get it. They wait to see whether the email, the clicked link or the attachment does something unexpected – whether it "detonates"… This includes contacting external IP addresses, downloading external files or manipulating operating system settings or the file system, i.e. actions you wouldn't expect when just reading an email or an attached PDF. If it detonates, quarantining that email is advised. Master the Boss Rush, defeat the Bosses. Over and over again. Like Don Quixote or Sisyphus.

CERN's mail service and Computer Security team are currently deploying a new Boss fighter, Xorlab's "ActiveGuard". ActiveGuard complements Microsoft's spam filter (Microsoft Exchange Online Protection, "EOP") and is intended to replace Microsoft's native solution, Microsoft Defender for Office (MDO), which was showing deficiencies when compared in detection quality with our previous solution from FireEye*. ActiveGuard is an in-line cloud solution for email protection, malware identification and containment, and malicious attachment detonation. It also comes with security enhancements based on commonly used industrial standards, namely DMARC validation. While this might break certain functionalities (like external mailing lists spoofing cern.ch email addresses), these standards significantly improve the security of any email exchange by preventing email sender spoofing. And fighting the Boss requires the right weapons…

All email users will benefit from the additional email protection provided by this Boss fighter. However, especially at the beginning while we're still fine-tuning the filtering of EOP and ActiveGuard, you might see a bit more unwanted mail either quarantined or delivered to your junk folder. In addition, another slight drawback we're still working on is that both solutions, EOP and ActiveGuard, provide you independently with information about the emails quarantined by them so that you can review and decide whether or not release them yourself. During the roll-out phase we hope to tune this in such a way that the number of false positives to be reviewed by you (and those to be reviewed by us!) reach an acceptable minimum. Have patience with us if we don't get it quite right at first, and be comforted by the fact that these new spam and malware appliances effectively and efficiently fight the Bosses for you!

** MDO was detecting only about 5–50% when forwarded the quarantined messages from FireEye, which have a very high true positive rate. Six months of discussion with Microsoft support have not resolved this discrepancy. With the new solution, we will repeat this exercise. However, what the (security) world might need is a "Virustotal" for email security products.*

Computer security team

Official news

Owners of residential property in France: Compulsory declaration by 31 July 2023

With the abolition of the "taxe d'habitation" (local council tax) for primary residences, as of 1 January 2023, a new compulsory declaration has now been introduced in France. It applies to all residential property owners, whether they are private individuals or companies, and is designed to enable local councils to identify those properties that are still liable for the tax (secondary residences, vacant property, etc.).

All residential property owners (private individuals, professionals, public institutions, foreign governments) are obliged to inform the French tax authorities of the nature of the occupancy of each property or, if they do not occupy a property themselves, state the identity of the occupant(s) and their period of occupancy (as at 1 January 2023).

This compulsory declaration can be made online only, via the website impot.gouv.fr (see https://www.service-public.fr/particuliers/actualites/A16336?lang=en). The 2023 declaration deadline is 31 July.

If you have any questions or difficulties making your declaration, you can contact:

- the helpline for private individuals on 0809 401 401 (local rates apply);
- the tax authorities via the online secure messaging platform (select the form “J’ai une question sur le service Biens immobiliers”) or using the contact details found in the “Contact et RDV” menu.

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

Information concerning the results of the concerted work stoppage on 2 June 2023 (from 13:30 to 14:30)

Following the concerted work stoppage on Friday 2 June 2023, motivated by the reasons mentioned in the Staff Association’s message dated 30 May, the HR department invited staff, fellows, and graduates to declare whether or not they had taken part in this action.

As indicated in the communication sent to the persons concerned, it was assumed that those who did not complete the electronic declaration form did not take part in the work stoppage.

The results are as follows:

	MPE (Staff, Fellow and Graduates)
Declarations: Yes (took part in the concerted work stoppage)	**249**
Declarations: No (did not take part in the concerted work stoppage)	**182**
Those requisitioned	99
Those not able to participate in the concerted work stoppage (leave, absence, training, …)	794
No reply (counted as no)	2213

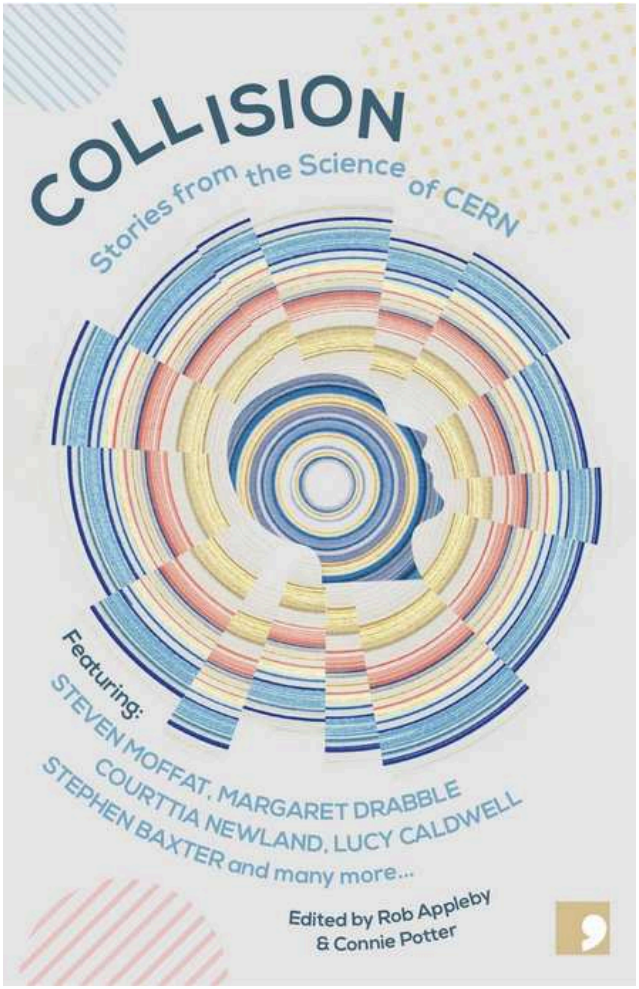
In accordance with Article 10 of the Note DG/270-81 dated 3 September 1981, for those who participated in the concerted work stoppage, a deduction will be made from their salary. The deduction of salary will be carried out on the July 2023 payslips.

HR department

Announcements

"Collision – Stories from the Science of CERN" – anthology book is now available

"Collision – Stories from the Science of CERN" is a highly readable anthology built on the idea of teaming up great writers with great scientists



Collision – Stories from the Science of CERN is a highly readable anthology built on the idea of teaming up great writers with great scientists. Each of the 13 stories is accompanied by an afterword from a member of the particle physics community. The authors are a very diverse bunch, so there's something for everyone – from exploring the nature of symmetry through the mirror of human interaction, to imagined historical encounters and, inevitably, the apocalyptic: we humans have always ventured into the unknown with trepidation.

All in all, the book makes for a varied, thought-provoking and engaging read. As with the Arts at CERN programme, it demonstrates that creativity is not the preserve of the arts or of science, and that great things can happen when the two collide.

To read the full review, go to the CERN Courier website : https://cerncourier.com/a/collision-stories-from-the-science-of-cern/

***Title**: Collision – Stories from the Science of CERN*
***Editors**: Rob Appleby, Connie Potter*
***Publisher**: Comma Press*
***Language**: English*
(Image: Comma press)

CERN Knowledge Transfer fund and Medical Applications budget 2023 – submit your application by 18 September

CERN's Knowledge Transfer (KT) group invites those who are working on a CERN technology that could be applied outside high-energy physics to submit applications for funding from the KT fund or the medical applications budget by 18 September

CERN's core business is fundamental science, but the Laboratory's technology and know-how have the potential to drive innovations in a variety of fields, often through collaborations with industrial partners.

CERN offers its personnel two funding schemes to help bridge the gap between research and

industry: the knowledge transfer (KT) fund and the medical applications (MA) budget. These mechanisms provide resources to help take early-stage, innovative projects from the Laboratory to society.

In order to be considered, a project must be based on CERN technologies, submitted by a member of the personnel and approved by the department head. Grants from the KT fund and the MA budget can cover material and equipment costs and allow CERN teams to hire associate members of the personnel or technical or PhD students to support the project's activities. The department must agree to cover the salaries of the personnel involved. The KT group is available to help you assess the technology and seek external partners such as companies, hospitals or universities.

If your technology has the potential for applications in healthcare, you should apply for funding from the MA budget. Before making your submission, you must present your proposal – even if it's not yet finalised – at one of the upcoming CERN Medical Applications Project Forum meetings on 23 August or 13 September. Please contact kt.medicalapplications@cern.ch as soon as possible to pre-book your slot. The full process is explained here: https://kt.cern/funding/ma-budget

If you are targeting applications outside the healthcare field, please apply for funding from the KT fund by following the instructions detailed here (https://kt.cern/funding/kt-fund). All ideas are welcome, particular those in the field of the environment or quantum and digital technologies. Complete applications must be submitted by 18 September 2023. Applicants will then present their proposals to the selection committee on 8 November 2023.

We encourage you to contact your Knowledge Transfer Internal Network (INET) representatives or the Knowledge Transfer group (kt@cern.ch) as early as possible to discuss opportunities.

Read more about how to apply for funding here:

- CERN Knowledge Transfer (KT) fund (https://kt.cern/funding/kt-fund)
- CERN Medical Applications budget (https://kt.cern/funding/ma-budget)

CERN Knowledge Transfer group

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!):
  - o Challenge the librarian!
  - o Hold your head high!
  - o 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!

Open calls for CineGlobe

The twelfth edition of CineGlobe, the international film festival inspired by science and technology, presents "Mauvais Je(ux)" - An experimental theatre production that plays games with your data.
This play by Gruppe Laokoon is produced in collaboration with CineGlobe and the GIFF (Geneva International Film Festival), and will take place on 9 November at the Science Gateway.

You can participate in the production in two ways:
-Open call for personal data (https://cineglobe.ch/en/2023/07/19/data-call-2023/)
-Casting call for performers (https://cineglobe.ch/en/2023/07/17/casting-calls-2023/)

Roadworks at the junction between Route Marie Curie and Route Scherrer: closure of junction and car parks

Following the announcement in June about roadworks on Route Marie Curie, the next phase of the project, the laying of the top surface, will take place on Friday, 28 July.
As a result, the junction between Route Marie Curie and Route Scherrer will be completely closed from 1.00 p.m. on 28 July until 6.00 a.m. on 29 July. The work will start at 1.30 p.m. and finish around 9.30 p.m.

The car parks and parking spaces opposite Buildings 38, 500, 501 and 510 will be closed off and inaccessible from 8.00 p.m. on 27 July until 6.00 a.m. on 29 July.
Please make the necessary arrangements with your services and contractors in order to minimise disruption.
We apologise for any inconvenience.

SCE department

Ombud's corner

From lone wolf to inclusive leadership (Act II)

In the previous issue of the Ombud's Corner, we met Stefano*, an experienced leader in the Organization who is reflecting on whether the authoritative management style that he has cultivated for years is still working for his career and, above all, for the well-being of his team.

We followed Stefano as he reflected on why he likes to take decisions unilaterally. He has now gained a better understanding of the reasons behind his reluctance to let go of control.

In this second act, we will see how Stefano determines which type of leader he wants to be, at this stage of his career.

It takes a lot of courage, effort and patience to move from being a lone wolf to an influential decision maker. It requires your team members and stakeholders to change their perception of you. Here are some ways to get started:

"No one knows everything." This is true of anyone and true of Stefano, and it is perfectly OK. Only by taking this humble view will Stefano be open to seeking other people's perspectives, knowledge, views and experience. More important than having the final word is the achievement of his team's objectives and the promotion of a collaborative spirit.

Asking for input is not a weakness. Stefano needs to acknowledge that his way is not the only way to do things. Searching for external factors and perspectives, opening up to other possibilities, far from damaging his authority, would increase the quality of his information and, therefore, his rate of success.

It may be difficult for Stefano, after such a long career in the Organization, to remain curious about new technologies, new trends, new people and new processes. Still, not only would curiosity allow him to make better decisions, including strategic ones, it might also put him in a better position for career advancement.

Finally, Stefano needs to determine whether he wishes to be a short-term or long-term thinker. Taking unilateral decisions without thinking about their impact in the longer term may have a negative impact on a team's morale and result in a loss of institutional knowledge and a potential decrease in productivity.

Dr A. Edmondson, in her book The Fearless Organization, reframes the role of the boss whom Stefano would like to be, using a matrix:

	Default frames	**Reframe**
The boss	Has answers	Sets directions
	Gives orders	Invites input to clarify and improve
	Assesses others' performance	Creates conditions for continued learning to achieve excellence
Others	Subordinates who must do what they are told	Contributor with crucial knowledge and insight

With a good understanding of the reasons behind his current inclination for an authoritarian style of management and a clear vision of the type of leader he would like to be, Stefano can now take practical steps to change. We will discover how in the next and concluding article on this topic.

Laure Esteveny

* Name is fictitious.

This article is inspired by a Harvard Business Review article (March 2023), Becoming More Collaborative — When You Like to Be in Control.

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