CERN Bulletin

Issue no. 21-22/2022
http://home.cern/cern-people

Higgs10: Three-quarters of the way there

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Press conference on the announcement of the W and Z bosons. From left to right: Carlo Rubbia, spokesman of the UA1 experiment; Simon van der Meer, responsible for developing the stochastic cooling technique; Herwig Schopper, Director-General of CERN; Erwin Gabathuler, Research Director at CERN, and Pierre Darriulat, spokesman of the UA2 experiment (Image: CERN)

4 July 2012 wasn't the first time physicists had packed themselves into the CERN auditorium to witness the discovery of a new elementary particle. To rapturous applause on 20 January 1983, Carlo Rubbia, spokesperson of the UA1 experiment at the Spp-barS collider, presented six candidate events for the W boson, the electrically charged carrier of the weak interaction responsible for radioactive decay. In similar scenes the following afternoon, Luigi Di Lella of the UA2 experiment announced four W candidates. Along with the Z boson and massless photon, the W boson is one of three "gauge" bosons of a unified electroweak interaction that demands the existence of a fourth "scalar" particle called the Higgs boson. Indirect evidence for the Z boson had been obtained a decade earlier at Gargamelle, driving the community to seek a direct discovery of the massive electroweak bosons. But their predicted masses – around 80 and 90 GeV for the W and Z, respectively – were beyond the reach of experi ...

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Matthew Chalmers

A WORD FROM JOACHIM MNICH

CERN moves closer to achieving full open access

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CERN moves closer to achieving full open access

Since 2014, CERN has required that all peer-reviewed primary research articles from CERN authors are published open access (OA), i.e. freely available for anyone around the world to read and re-use with appropriate attribution. This policy reflects the moral imperative of CERN as a publicly-funded organisation – supported by contributions from its Member States – to ensure that the results of our work accrue benefits to all.

I'm pleased to report that we are close to achieving full policy compliance: **in 2021, 93.7% of the 1058 publications from CERN authors were published OA.**

Credit for this achievement belongs to the members of our research community, who have long understood the importance of open access for their research in increasing visibility and enabling re-use and collaboration. In order to make it as easy as possible for CERN authors to comply with our policy, the CERN Scientific Information Service (SIS) has established a number of enabling mechanisms, thanks to which the OA share of CERN publications is gradually increasing.

The most impactful of these mechanisms is SCOAP3 (Sponsoring Consortium for Open Access Publishing in Particle Physics), which has arranged for automatic OA to research in high-energy physics, published in 11 of the leading journals in the discipline (participating journals (https://scoap3.org/phase3-journals/)). This initiative – supported by a global community of over 3000 libraries – has not only helped support the majority of CERN's research to be published openly, its global, discipline-wide approach has extended this benefit to researchers around the world. Since its launch in 2014, SCOAP3 has enabled the barrier-free publishing of almost 50 000 research articles by authors from over 120 countries.

The next largest contributors to CERN's OA research output – and growing in popularity – are the numerous agreements that the SIS has secured with relevant publishers. Since 2020, seven Read & Publish agreements (which combine OA publishing rights with read-only access to content) with AIP, APS, Elsevier, IEEE, IOP, Springer-Nature and Wiley have been established. Through these, CERN authors are now able to publish their research papers OA in more than 3800 journals. These agreements cover primarily research articles by CERN authors and, in many cases, CERN experiment collaborations.

To assist CERN authors in identifying their OA publishing options, a comprehensive author guide (https://scientific-info.cern/cern-author-guide) has been developed. CERN authors are encouraged to select SCOAP3 journals whenever possible and, for outside HEP, journals covered under existing agreements should be prioritised.

The mechanisms described in the author guide cover the vast majority of journals in areas relevant to CERN. To honour our commitment to ensuring OA to our output across all disciplines, a very limited central fund has been dedicated to pay for author fees of articles submitted to journals that are not covered by existing agreements. Eligibility for this funding is available only under certain conditions, with specific regulations in place for high-cost journal publications.

When selecting publication venues, it is important to note that research funders are increasingly de-emphasising journal impact factors when evaluating research proposals. For example, the new European Commission Horizon Europe Programme Guide (https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/programme-guide_horizon_en.pdf) indicates that: "The significance of publications will not be evaluated on the basis of the Journal Impact Factor of the venue they are published in, but on the basis of a qualitative assessment provided by the proposers for each publication." Following the Paris call on Research Assessment (https://osec2022.eu/paris-call/), a broad coalition across European institutions and funders is currently being established to reform the research assessment processes and practices in favour of more qualitative measures. CERN has joined this initiative and, as a result, CERN authors are discouraged from using the impact factor as a criterion when selecting a publication outlet.

Achieving 100% OA to CERN's research output is not simply an aspiration; it is a policy requirement and a key element of our holistic approach to open science, the comprehensive practice of which we believe is central to delivering on our scientific mission. The SIS has published detailed information about the range of options available for you to publish your work OA (including the author guide (https://scientific-info.cern/cern-author-guide)). With your help, we can reach our goal and continue to set a new global standard for scientific openness.

CERN authors are encouraged to contact the SIS – in particular, the resident OA expert, Anne Gentil-Beccot – for advice in advance of a submission.

Joachim Mnich

Higgs10: Three-quarters of the way there

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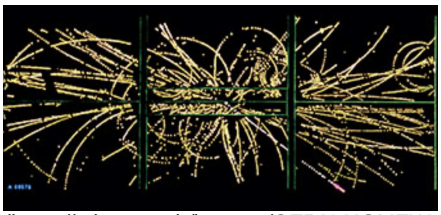
Press conference on the announcement of the W and Z bosons. From left to right: Carlo Rubbia, spokesman of the UA1 experiment; Simon van der Meer, responsible for developing the stochastic cooling technique; Herwig Schopper, Director-General of CERN; Erwin Gabathuler, Research Director at CERN, and Pierre Darriulat, spokesman of the UA2 experiment (Image: CERN)

4 July 2012 wasn't the first time physicists had packed themselves into the CERN auditorium to witness the discovery of a new elementary particle. To rapturous applause on 20 January 1983, Carlo Rubbia, spokesperson of the UA1 experiment at the Spp-barS collider, presented six candidate events for the W boson, the electrically charged carrier of the weak interaction responsible for radioactive decay. In similar scenes the following afternoon, Luigi Di Lella of the UA2 experiment announced four W candidates. Along with the Z boson and massless photon, the W boson is one of three "gauge" bosons of a unified electroweak interaction that demands the existence of a fourth "scalar" particle called the Higgs boson.

Indirect evidence for the Z boson had been obtained a decade earlier at Gargamelle (https://home.cern/news/series/higgs10/higgs-boson-and-rise-standard-model-particle-physics-1970s), driving the community to seek a direct discovery of the massive electroweak bosons. But their predicted masses – around 80 and 90 GeV for the W and Z, respectively – were beyond the reach of experiments at the time. In 1976, Rubbia, Peter McIntyre and David Cline suggested modifying the CERN SPS from a one-beam accelerator into a machine that would collide beams of protons and antiprotons, greatly increasing the available energy. Simon van der Meer (https://cerncourier.com/cws/article/cern/46057) had already

invented a way of producing and storing dense beams (https://home.cern/about/engineering/stochastic-cooling) of protons or antiprotons, while his “stochastic cooling” method to reduce the energy spread and angular divergence of the beams had been honed at the Intersecting Storage Rings (the world’s first hadron collider). Many doubted the wisdom of the decision, however, especially as CERN was keen to push its visionary Large Electron–Positron (LEP) collider.

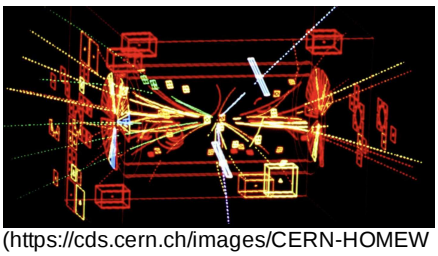


(https://cds.cern.ch/images/CERN-HOMEWEB-PHO-2022-102-3)

First direct production of the W boson in the UA1 detector in late 1982 (Image: CERN)

As former UA2 spokesperson Pierre Darriulat wrote in *CERN Courier* in 2004: “The pressure to discover the W and Z was so strong that the long design, development and construction time of the LEP project left most of us, even the most patient, dissatisfied. A quick (but hopefully not dirty) look at the new bosons would have been highly welcome. But when proton–proton colliders such as the Superconducting Intersecting Storage Rings were proposed in this spirit, they were ‘killed in the egg’ by the management at CERN, with the argument that they would delay – or, even worse, endanger – the LEP project. The same argument did not apply to the proton–antiproton collider, as it did not require the construction of a new collider ring and could be proposed as an experiment … Another argument also made it possible for the proton–antiproton project to break the LEP taboo: if CERN did not buy Carlo’s idea, it was most likely that he would sell it to Fermilab.”

Two detectors, UA1 (https://home.cern/about/experiments/ua1) and UA2 (https://home.cern/about/experiments/ua2), built around the Spp-barS beam pipe to search for signatures of the W and Z particles, started taking collision data in 1981. When they confirmed the existence of the W boson – which was announced at a press conference at CERN on 25 January 1983, followed by the discovery of the Z boson a few months later and the Nobel Prize in Physics for Rubbia and Van der Meer the following year –



(https://cds.cern.ch/images/CERN-HOMEWEB-PHO-2022-102-2)

First direct production of the Z boson in the UA1 detector in April 1983 (Image: CERN)

the case for the existence of the Higgs boson grew stronger. That’s because all three bosons hail from the same “Mexican hat”-shaped Brout-Englert-Higgs (BEH) field that broke the electroweak symmetry a fraction of a nanosecond after the Big Bang and left the universe with a non-zero vacuum expectation value. As the universe transitioned from a symmetrical state at the top of the hat to a more stable configuration in the rim, three of the BEH field’s four mathematical components were absorbed to generate masses for the W and Z bosons (while keeping the photon massless); the fourth, corresponding to an otherworldly oscillation up and down the rim of the Mexican hat, is the Higgs boson.

In 1983, assuming that the electroweak Standard Model and BEH mechanism were correct, three quarters of the BEH field had been discovered. LEP went on to measure the properties of the W and Z bosons in great detail, helping to constrain the possible hiding places for the “remaining quarter”. The Standard Model does not predict the mass of the Higgs boson. Finding it would require an even more powerful machine. Thanks to the foresight of CERN Director-General John Adams in 1977, the LEP tunnel was designed to be large enough to accommodate the proton–proton collider that, 35 years later, would uncover the final quarter of the mysterious scalar field that pervades the universe and gives mass to elementary particles.

The announcement of the W and Z bosons in 1983 (Video: CERN (https://videos.cern.ch/record/1507644))

Matthew Chalmers

The Schools Challenge: time to open the boxes!

On Friday, 13 May, local primary schoolchildren attended an event in the Globe of Science and Innovation to reveal the contents of boxes they had carefully prepared as a challenge for CERN’s scientists

Pupils from the Jean de la Fontaine school (Prévessin-Moëns, France) and the Cérésole school (Petit-Lancy, Switzerland) with CERN scientists during the closing event. (Image: CERN)

Since 2011, the *Be a Scientist* (https://voisins.cern/en/be-scientist) project has been introducing pupils from schools in Geneva, the Pays de Gex and Haute-Savoie to the scientific research process. The pupils, aged between 8 and 12, come up with hypotheses, collect data and use facts and figures to work out the contents of boxes provided by CERN that they are not allowed to open or damage.

This year, to mark the project’s tenth anniversary, the roles were reversed. In June 2021, pupils from the Jean de la Fontaine school (Prévessin-Moëns, France) and the Cérésole school (Petit-Lancy, Switzerland) hid various objects in two boxes and challenged CERN’s scientists to identify them.

Five pairs of scientists carried out investigations over several months. Each pair, in turn, put their resourcefulness to the test, combining theory and facts in an attempt to solve the mystery. Armed with scales, magnets, an infrared camera and even an endoscope, they performed several experiments, not all of which were very successful... The final team was at a considerable advantage, however, as they were able to X-ray the boxes.

(https://cds.cern.ch/images/CERN-PHOTO-202205-080-10)

The box assembled by the pupils from the Cérésole school (Petit-Lancy, Switzerland) and its contents: two hazelnuts, a bell attached to a cow made of plastic beads, a tea bag, ten magnetic tokens, a wooden keyring in the shape of a dice, two unbreakable metal mirrors, a mini Rubik’s cube, an egg timer, a finger guide), a telescopic back /head scratcher and a coffee capsule.

The *Schools Challenge* (https://voisins.cern/en/defi) was rounded off in style on Friday, 13 May 2022, in CERN’s Globe of Science and Innovation, where the children got to meet the scientists who had taken up their challenge

and revealed the contents of the boxes to them. The sound from the Swiss box was effectively coming from a bell, as the CERN detectives had guessed, and the bell was attached to a cow made of plastic beads. However, the teams got a surprise when they discovered that the origin of the beeping noise from the French box was a “Klockis” alarm-timer and not a metal detector! The boxes contained other surprises too (tea for the smell, a metal plate to create magnetism, an oloid for its misleading shape, a lemon for the loss of weight, etc.), so the children had missed no opportunity to throw the scientists off the scent.

You can find the video and photos of the closing event on the event website (https://indico.cern.ch/event/1147145/).

Go to the voisins.cern (https://voisins.cern/en/defi) website to find out more about the scientists’ invesitgations and the latest news from the *Schools Challenge* programme.

(https://cds.cern.ch/images/CERN-PHOTO-202205-080-9)

The box put together by the pupils from the Jean de la Fontaine school (Prévessin-Moëns, France) and its contents: an oloid and its mathematical formula, a lemon, a sleigh bell, a Klockis alarm-timer, two plastic spiders, an RFID card, a metal plate and a teabag with curry inside.

A year dedicated to celebrating basic science

In July 2022, a whole year devoted to celebrating basic sciences for sustainable development gets under way

IYBSSD2022
International Year
of Basic Sciences
for Sustainable Development

(Image: IUPAP)

The United Nations General Assembly has proclaimed 2022 to be the International Year of Basic Sciences for Sustainable Development (IYBSSD). This initiative is championed by the International Union of Pure and Applied Physics (IUPAP) together with other international scientific unions and international scientific organisations across the world, including CERN, covering all disciplines of basic science.

In parallel, IUPAP will celebrate the 100th anniversary of its foundation in Brussels. IUPAP was established to assist the worldwide development of physics, to foster international cooperation in physics, and to help in the application of physics to solving problems of concern to humanity. IUPAP is the only global scientific union dedicated to physics, connecting physicists from all fields and all continents.

The year of festivities will start with a webcasted ceremony hosted by UNESCO at its headquarters in Paris on 8 July, where CERN will be represented by Director for International Relations Charlotte Lindberg Warakaulle. The programme is being finalised and includes addresses from the President of the Republic of Honduras, the UN Secretary-General, the Director-General of UNESCO and the President of IUPAP. Former CERN Director-General Rolf Heuer, now President of the SESAME Council, will lead a high-level panel discussion on the role of science in decision-making processes, and there will be a round table with leading scientists discussing the role of basic sciences in education, the foundations of applied sciences, disruptive discoveries, serendipity, openness and inclusiveness. Finally, there will be sessions on how basic sciences, as a public good, can serve in addressing the global challenges set out in the UN Sustainable Development Goals and on the importance and impact of investing in basic sciences. It is expected that the closing ceremony of the IYBSSD will take place at CERN Science Gateway in September 2023.

(https://cds.cern.ch/images/CERN-HOMEWEB-PHO-2022-097-1)

The UN Sustainable Goals (Image: United Nations)

In the following week, from 11 to 13 July, the IUPAP Centennial Symposium will take place at the International Centre for Theoretical Physics (ICTP) in Trieste. The organisers hope that many people will be able to participate in person, but the meeting will be fully hybrid with the possibility of active remote participation. The Symposium will include plenary talks by keynote speakers and other activities with an emphasis on aspects of IUPAP history and international collaborations – including the integration of communities from developing countries – as well as physics education and many other items consistent with the IUPAP mission.

Among the speakers are Nobel laureates Takaaki Kajita, Giorgio Parisi, Donna Strickland and William Phillips, to mention just a few. On its opening day, the Symposium will be linked via videoconference to the International Conference on High Energy Physics (ICHEP 2022) taking place in Bologna at the same time. On this occasion, Anatoly Zagorodny, President of the National Academy of Sciences of Ukraine, will give an address to the combined meetings directly from his office in Kyiv. The IUPAP Symposium will also include several panel discussions on topics such as the underrepresentation of women and other groups, early-career researchers, science advising policy, physics outside academia, physics for development and physics education.

Remote participation:

- **IYBSSD opening ceremony**: the link to connect will be published in the *Bulletin* as soon as it becomes available.
- **IUPAP100:** to participate, register via “Apply here” (https://indico.ictp.it/event/9874/overview).

Jens Vigen

Pre-registration for the Higgs anniversary symposium is now open

The 10th anniversary of the Higgs boson's discovery will be marked by a symposium on 4 July celebrating a decade of Higgs boson physics, discussing the latest results and looking to the future

Excitement in the CERN main auditorium moments before the announcement of the discovery of the Higgs boson (Image: CERN)

On 4 July 2012, a packed CERN Auditorium learned that the long-awaited Brout-Englert-Higgs mechanism had finally been revealed by the ATLAS and CMS experiments at CERN. The subsequent 10 years have seen impressive advances in our understanding of the Higgs boson's properties, and there is much more still to be learned.

The centrepiece of the celebrations of the 10th anniversary of this astounding discovery is a full-day (9.00 a.m.–6.00 p.m.) scientific symposium (https://indico.cern.ch/event/1135177/) in CERN's main auditorium on 4 July. Speakers will share their recollections of the discovery, look at what's been learned since, present the latest results and take a look ahead at what's still to come.

Register on Indico (https://indico.cern.ch/event/1135177/registrations/83321/) to attend the in-person event in the main auditorium (registration subject to approval for capacity reasons). The symposium will also be relayed to the Council Chamber and, for those who cannot attend, the full symposium will be webcast with live captions (the morning session will also be webcast in French).

Environmental awareness: managing and optimising CERN's electricity consumption

Use less, increase efficiency, recover more

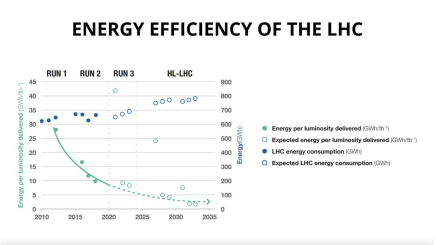
400 kV & 66 kV electrical network consolidation and maintenance during LS2 (Image: CERN)

In periods of operation, CERN's accelerators, detectors and test facilities account for more than 90% of the Laboratory's yearly average electricity consumption of 1.2 TWh. These powerful research instruments are what makes CERN's unique scientific programme possible, supporting a global community of scientists in their fundamental physics research. Every effort is made to run them in the most energy-efficient way possible.

CERN is committed to limiting its increase in electricity consumption to 5% up to the end of Run 3 (baseline year: 2018*). To do so, CERN takes a comprehensive approach, carefully considering and evaluating every possible energy-saving activity to ensure complementary and maximum impact. Efforts to improve energy efficiency are guided by the Energy Management Panel (EMP), set up in 2015 to support the recent market-based electricity contract as well as to raise awareness of the need for energy efficiency at CERN. The panel brings together representatives of CERN's most energy-intensive activities.

The Organization's electricity distribution is monitored via an integrated WebEnergy tool (https://home.cern/news/news/computing/release-webenergy-20-tool-managing-your-electricity-consumption-cern-just-got) developed by the EN department with guidance from the EMP. WebEnergy measurements rely on monitoring tools with an accuracy better than 1%. This precise monitoring helps increase awareness among energy-intensive departments and services. The tool also makes it possible to conduct forecasting for optimisation: CERN sends the result of the forecast modelling, which is based on CERN's accelerator schedule, to the energy contractor and regularly receives a bonus for the precision of this forecast, i.e. +/- 15% for at least 10 months per year.

When in operation, the LHC is responsible for some 55% of CERN's energy consumption. In the coming years, the luminosity (the number of collisions produced by the LHC) will increase substantially. Higher luminosity equates to more data for the experiments, giving them greater precision and more potential for new discoveries, but it also comes at the cost of greater energy consumption. CERN has developed a specific metric to illustrate the quantity of electricity used per unit of luminosity delivered, expressed as gigawatt hours per inverse femtobarn (GWh/fb^{-1}). With respect to Run 1, the HL-LHC will increase the energy efficiency of CERN's flagship facility by a factor of ten over 20 years.



(https://cds.cern.ch/images/CERN-HOMEWEB-PHO-2022-094-1)

(Image: CERN)

With the growing environmental awareness of the recent decades, CERN strives to be an example for environmentally-friendly research. Energy is one of the factors in reducing the Organization's ecological footprint. With energy prices set to increase significantly in coming years, which will have a concomitant impact on CERN's budget, and following an internal audit carried out in 2021, the Organization has initiated the process of obtaining the ISO 50 001 certification (https://www.iso.org/iso-50001-energy-management.html) for energy management. A critical step in this process is to document the Laboratory's energy baseline and define complementary energy performance indicators covering the Organization's main energy uses in addition to the aforementioned metric for the LHC. It also requires objectives and energy targets to be specified and a plan drawn up to achieve them. The aim is to issue an energy performance plan covering these items to the French authorities by mid-2022. The process will entail reviewing and completing CERN's energy policy, designing new tools to measure performance, and organising formal audits

carried out by an accredited certification body (planned for the end of the year). In this context, all future initiatives aimed at improving energy performance will be assessed according to the requirements of the ISO 50 001 standard. Obtaining the certification will allow CERN to receive a significant rebate on its electricity transmission costs for the coming years.

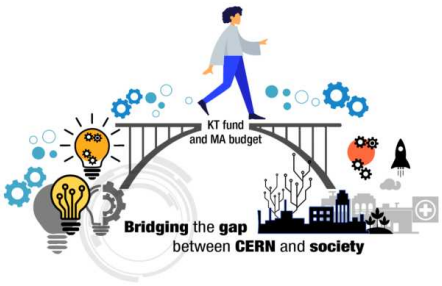
Although energy consumption from the tertiary sector, such as buildings, the data centre and conventional facilities, only represents up to 10% of CERN's total electricity consumption during LHC operation periods, meaningful improvements can also be achieved there. In this vein, the SCE department carries out two building renovations per year with a view to improving energy performance, comfort level and safety conformity. CERN's public and indoor lighting is gradually being replaced. Studies are ongoing into recovering waste heat from the new CERN Data Centre in Prévessin to heat surrounding buildings, thus reducing emissions from the gas heating plant. Furthermore, plans are under way to use heat recovered from CERN's cooling tower units at LHC Point 1 to heat buildings on the Meyrin site.

Use less, increase efficiency, recover more: these three principles underpin CERN's strategy for energy management. And we all have a role to play, to ensure that each megawatt hour used brings added value to CERN's performance and mission.

*See CERN's first public Environment Report (https://hse.cern/environment-report-2017-2018/energy).

KT fund and MA budget: bridging the gap between CERN research and society

Apply to the Knowledge Transfer (KT) fund and Medical Application (MA) budget if you work on a technology that could be applied outside of high-energy physics



(Image: CERN)

To maximise the Organization's technological and knowledge return to society, CERN offers its personnel two funding schemes: the CERN Knowledge Transfer (KT) fund (https://kt.cern/funding/kt-fund) and the CERN Medical Applications budget (https://kt.cern/funding/ma-budget). These mechanisms provide resources to help take early-stage, innovative projects from the Laboratory to society, bridging the gap between research and industry.

Any project based on CERN technologies with high potential for impact in a field outside high-energy physics can qualify. Since 2011, over 100 projects have been funded, spanning technological fields and applications from healthcare to aerospace, with funding ranging from 15 to 904 kCHF per project.

The following articles about CERN colleagues highlight how KT support (through funding or other means) have benefited their projects:

- Gaining perspective in intellectual property (https://kt.cern/article/gaining-perspective-intellectual-property) – Hélène Mainaud-Durand, Mechatronics and Measurements group
- When research radiates beyond the lab (https://kt.cern/article/when-research-radiates-beyond-lab) – Marco Silari, Radiation Protection group
- Rooted in society (https://kt.cern/article/rooted-society) – Axel Naumann, Software Design for Experiments group
- The rise of the radiation protection robots (https://kt.cern/news/news/spotlight-series/rise-radiation-protection-robots) – Mario Di Castro, Mechatronics, Robotics and Operations section
- Materials that matter (https://kt.cern/news/news/spotlight-series/materials-matter) – Jorge Guardia-Valenzuela, Mechanical and Materials Engineering group

The development of human capital is central to KT funding activities. The grants contribute to material and equipment costs, and allow CERN teams to hire associate members or technical or PhD students to support R&D activities. The KT group can also help you assess the technology and seek external partners such as companies, hospitals or universities.

The upcoming deadline for KT funding opportunities for CERN personnel is **8 August 2022. We especially look forward to welcoming project proposals which support the environment (please have a look at the CIPEA page (https://kt.cern/environment/CIPEA)).** If the technology you are developing can be applied to healthcare, please apply for funding from the MA budget and present your proposal – even if it's not finalised – at one of the Medical Applications Project Forum meetings, on **15 June or 13 July.** Please contact kt.medicalapplications@cern.ch as soon as possible to book your slot.

We encourage you to contact your INET coordinator (https://knowledgetransfer.web.cern.ch/collaborations-and-networks/internal-network) or the Knowledge Transfer group as early as possible to discuss opportunities.

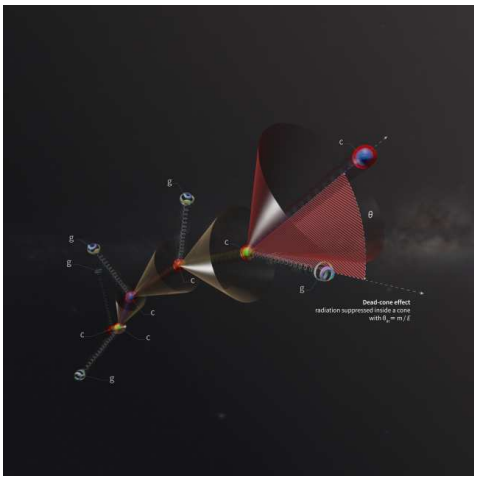
Read more about the funding schemes on the following pages:

- 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

ALICE makes first direct observation of a fundamental effect in particle physics

The observation provides direct experimental access to the mass of an elementary particle known as the charm quark



A charm quark (c) in a parton shower loses energy by emitting radiation in the form of gluons (g). The shower displays a dead cone of suppressed radiation around the quark for angles smaller than the ratio of the quark's mass (m) and energy (E). The energy decreases at each stage of the shower. (Image: CERN)

The ALICE collaboration at the Large Hadron Collider (LHC) has made the first direct observation of the dead-cone effect – a fundamental feature of the theory of the strong force that binds quarks and gluons together into protons, neutrons and, ultimately, all atomic nuclei. In addition to confirming this effect, the observation, reported in a paper published today in *Nature* (https://www.nature.com/articles/s41586-022-04572-w), provides direct experimental access to the mass of a single charm quark before it is confined inside hadrons.

"It has been very challenging to observe the dead cone directly," says ALICE spokesperson Luciano Musa. "But, by using three years' worth of data from proton–proton collisions at the LHC and sophisticated data-analysis techniques, we have finally been able to uncover it."

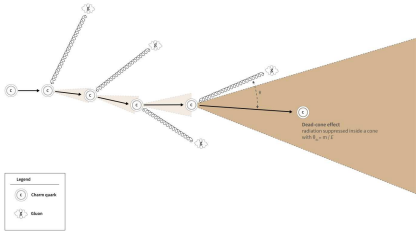
Quarks and gluons, collectively called partons, are produced in particle collisions such as those that take place at the LHC. After their creation, partons undergo a cascade of events called a parton shower, whereby they lose energy by emitting radiation in the form of gluons, which also emit gluons. The radiation pattern of this shower depends on the mass of the gluon-emitting parton and displays a region around the direction of flight of the parton where gluon emission is suppressed – the dead cone[1].

Predicted thirty years ago from the first principles of the theory of the strong force, the dead cone has been indirectly observed at particle colliders. However, it has remained challenging to observe it directly from the parton shower's radiation pattern. The main reasons for this are that the dead cone can be filled with the particles into which the emitting parton transforms, and that it is difficult to determine the changing direction of the parton throughout the shower process.

The ALICE collaboration overcame these challenges by applying state-of-the-art analysis techniques to a large sample of proton–proton collisions at the LHC. These techniques can roll the parton shower back in time from its end-products – the signals left in the ALICE detector by a spray of particles known as a jet. By looking for jets that included a particle containing a charm quark, the researchers were able to identify a jet created by this type of quark and trace back the quark's entire history of gluon emissions. A comparison between the gluon-emission pattern of the charm quark with that of gluons and practically massless quarks then revealed a dead cone in the charm quark's pattern.

The result also directly exposes the mass of the charm quark, as theory predicts that massless particles do not have corresponding dead cones.

"Quark masses are fundamental quantities in particle physics, but they cannot be accessed and measured directly in experiments because, with the exception of the top quark, quarks are confined inside composite particles," explains ALICE physics coordinator Andrea Dainese. "Our successful technique to directly observe a parton shower's dead cone may offer a way to measure quark masses."



(https://cds.cern.ch/images/CERN-GRAPHICS-2022-015-8)

As the parton shower proceeds, gluons are emitted at smaller angles and the energy of the quark decreases, resulting in larger dead cones of suppressed gluon emission. (Image: CERN)

Further information:

- Additional graphics (https://cds.cern.ch/record/2809214)
- ALICE picture gallery
- ALICE video gallery
- ALICE collaboration: https://alice.cern/ (https://alice.cern/)

[1]Technical note: specifically, for an emitter of mass m and energy E, gluon emission is suppressed at angles smaller than the ratio of m and E, relative to the emitter's direction of motion.

CLOUD discovers new way by which aerosols rapidly form and grow at high altitude

The resultant particles quickly spread around the globe, potentially influencing Earth's climate on an intercontinental scale

View of the CLOUD experiment at CERN (Image: CERN)

Aerosol particles can form and grow in Earth's upper troposphere in an unexpected way, reports the CLOUD (https://home.cern/science/experiments/cloud) collaboration in a paper (https://www.nature.com/articles/s41586-022-04605-4)[1] published today in Nature. The new mechanism may represent a major source of cloud and ice seed particles in areas of the upper troposphere where ammonia is efficiently transported vertically, such as over the Asian monsoon regions.

Aerosol particles are known to generally cool the climate by reflecting sunlight back into space and by making clouds more reflective. However, how new aerosol particles form in the atmosphere remains relatively poorly known.

"Newly formed aerosol particles are ubiquitous throughout the upper troposphere, but the vapours and mechanisms that drive the formation of these particles are not well understood," explains CLOUD spokesperson Jasper Kirkby. "With experiments performed under cold upper tropospheric conditions in CERN's CLOUD chamber, we uncovered a new mechanism for extremely rapid particle formation and growth involving novel mixtures of vapours."

Using mixtures of sulfuric acid, nitric acid and ammonia vapours in the chamber at atmospheric concentrations, the CLOUD team found that these three compounds form new particles synergistically at rates much faster than those for any combination of two of the compounds. The CLOUD researchers found that the three vapours together form new

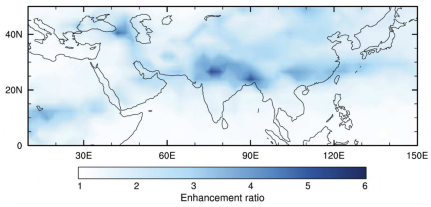
particles 10–1000 times faster than a sulfuric acid–ammonia mixture, which, from previous CLOUD measurements, was previously considered to be the dominant source of upper tropospheric particles. Once the three-component particles form, they can grow rapidly from the condensation of nitric acid and ammonia alone to sizes where they seed clouds.

Moreover, the CLOUD measurements show that these particles are highly efficient at seeding ice crystals, comparable to desert dust particles, which are thought to be the most widespread and effective ice seeds in the atmosphere. When a supercooled cloud droplet freezes, the resulting ice particle will grow at the expense of any unfrozen droplets nearby, so ice has a major influence on cloud microphysical properties and precipitation.

The CLOUD researchers went on to feed their measurements into global aerosol models that include vertical transport of ammonia by deep convective clouds. The models showed that, although the particles form locally in ammonia-rich regions of the upper troposphere such as over the Asian monsoon regions, they travel from Asia to North America in just three days via the subtropical jet stream, potentially influencing Earth's climate on an intercontinental scale.

"Our results will improve the reliability of global climate models in accounting for aerosol formation in the upper troposphere and in predicting how the climate will change in the future," says Kirkby. "Once again, CLOUD is finding that anthropogenic ammonia has a major influence on atmospheric aerosol particles, and our studies are informing policies for future air pollution regulations."

Atmospheric concentrations of sulfuric acid, nitric acid and ammonia were much lower in the pre-industrial era than they are now, and each is likely to follow different concentration trajectories under future air pollution controls. Ammonia in the upper troposphere originates from livestock and fertiliser emissions – which are unregulated at present – and is carried aloft in convective cloud droplets, which release their ammonia upon freezing.



(https://cds.cern.ch/images/CERN-HOMEWEB-PHO-2022-105-1)

Simulation of aerosol particle formation during the Asian monsoon in a global aerosol model with efficient vertical transport of ammonia into the upper troposphere. Including a mixture of sulfuric acid, nitric acid and ammonia enhances upper-tropospheric particle number concentrations over the Asian monsoon region by a factor of 3–5 compared with the same model with only sulfuric acid and ammonia. (Image: CLOUD collaboration)

Pictures: https://cds.cern.ch/record/2806655 (https://cds.cern.ch/record/2806655)

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[1]Wang, M. et al. Synergistic HNO3–H2SO4–NH3 upper tropospheric particle formation. Nature, doi:10.1038/s41586-022-04605-4 (https://www.nature.com/articles/s41586-022-04605-4) (2022).

Computer Security

Computer Security: Catch me if you can

The Zebra Scientific Alliance has been compromised; hit hard by an attacker. Zebra's IT experts and computer emergency response teams are on the prowl, trying to get to the bottom of the malicious deeds

Zebra Scientific Alliance

(https://cds.cern.ch/images/CERN-HOMEWEB-PHO-2022-104-1)

(Image: CERN)

The Zebra Scientific Alliance has been compromised; hit hard by an attacker. Zebra's IT experts and computer emergency response teams are on the prowl, trying to get to the bottom of the malicious deeds. The scenario is opaque. Details are unclear. Log files are missing. Time is running out. Pressure rises. Police is pushing. Journalists are inquiring. And nothing is as it seems.

Fortunately, Zebra is not real. Fortunately, nobody has been attacked here. Fortunately, this is just a table-top exercise for system administrators, computing personnel and security experts to better understand the complexity of today's IT sphere, the interconnectivity of data centres and the problems that can arise when resolving large-scale cyber-security incidents. A mysterious, but serious, crime, for which teams have to join forces. In order to save the Zebra Scientific Alliance from disaster. To protect its reputation. To enable research to resume quickly. And to find the culprit who has put Zebra's mission at risk.

The exercise has been designed to depict the complexity of real computer security incidents as handled in the past by the CERN, EGI and WLCG computer incident response teams (CSIRTs). Usually, such incidents are vast, involving lots of different partners, several physically distant sites and administrators responsible for different layers of the local software stack, like the operating system, web application and databases. Some administrators might not understand or know what is running within their data centre, others are busy with daily operations and reluctant to help, and others might not even speak or understand your language. Local computer emergency response teams might lack the necessary skills or tools or simply do not exist. Access and system logs are usually incomplete and almost certainly distributed such that they would need to be gathered together to have a more holistic picture of what goes on. Attackers are using their skills to further obfuscate this picture, trying to hide their traces, manipulate or purge logs and sabotage any incident investigation in order to avoid getting caught. And management is pressing to get that incident resolved so that personnel resources can focus on their core work again and computing services can resume operations.

In summary, large-scale computer security incident response is stressfully fun. This exercise will bring that fun to you. Teaching you the inherent problems of incident response. Making you aware of the struggles involved. And pointing you towards ways that we all can do better.

So, stay tuned. Zebra will soon be coming to a theatre at CERN too, looking to recruit people with a bit of an IT or security background to participate in this table-top exercise designed to promote better understanding of large-scale incident response. Sign up to get the call at cert-info@cern.ch (https://e-groups.cern.ch/e-groups/EgroupsSubscription.do?egroupName=cert-security-info (https://e-groups.cern.ch/e-groups/EgroupsSubscription.do?egroupName=cert-security-info)).

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

Computer Security team

Official news

A message from the Medical Service on monkeypox

A small number of cases of monkeypox have recently been reported in Europe, including some in CERN's Host States (https://www.ge.ch/document/variole-du-singe-premier-cas-detecte-dans-canton-geneve). Monkeypox is an infectious disease caused by a virus that is transmitted from animals to humans, and that can also be transmitted from human to human. It is characterised by fever, flu-like symptoms and skin lesions. Symptoms usually resolve spontaneously within 2-4 weeks, and complications are rare.

At this stage, the risk of contagion in the general population is classified as being very low by the health authorities (see this page (https://www.ecdc.europa.eu/en/publications-data/risk-assessment-monkeypox-multi-country-outbreak)). The HSE Unit, and in particular the Medical Service, are monitoring the development of the situation and will recommend specific measures if necessary.

If you have symptoms that may suggest monkeypox, you should isolate yourself and contact your doctor.

For more information, see the dedicated webpage on the Medical Service's website (https://hse.cern/monkeypox).

Medical Service

Voluntary insurances available for staff members and fellows

Two types of optional insurances are available, on a voluntary basis, to CERN staff members and fellows.

1. Loss of earnings insurance:

In accordance with Article R II 4.13 of the Staff Rules and Regulations, remuneration of an employed member of the personnel is reduced after more than 12 cumulative months of sick leave in any 36 month period (other than a period of sick leave due to an occupational illness or accident). Remuneration is reduced to two-thirds for between 12 and 30 months of sick leave, and no remuneration is paid from 30 to 36th month.

CERN has established a collective loss of earnings insurance policy with UNIQA to enable employed members of the personnel to protect themselves from this reduction in remuneration.

All the details about this insurance and the affiliation procedure are available in the Admin e-Guide (https://admin-eguide.web.cern.ch/en/procedure/loss-earnings-insurance).

2. Life Insurance:

CERN has established a group insurance policy with the HELVETIA Swiss Life Insurance Company Ltd. This policy, whose conditions were revised on 1 January 2022, enables employed members of the personnel to purchase life insurance on favourable terms.

All the details about this insurance and the affiliation procedure are available in the Admin e-Guide (https://admin-eguide.web.cern.ch/en/procedure/life-insurance-helvetia).

The personnel accounting service of the FAP department (service-personnel-accounting@cern.ch) can be contacted for any further information concerning these two insurances.

FAP department

Announcements

18 June: the CERN MusiClub invites you to "Music on the Lawn"

(https://cds.cern.ch/images/CERN-HOMEW EB-PHO-2022-103-1)

(Image: CERN)

The CERN MusiClub is pleased to announce that, as part of the *"Fête de la musique"* 2022, the club will be organising "Music on the Lawn" on **Saturday 18 June on the terrace of Restaurant 1**, on the Meyrin site. Music will start at 14h and finishes around 18h.

"*Music on the Lawn*" is a free rock concert featuring bands from the CERN MusiClub. This year's event, the first since 2019, will feature RPM2, Diracula (https://www.facebook.com/Diracula-1045961388764715/) and the Canettes Blues Band (https://canettes.web.cern.ch/), plus a DJ set.

After a two-year hiatus, the CERN MusiClub is also planning this year's *Hardronic Music Festival* (https://club-musiclub.web.cern.ch/hardronic) to be held on 23 July on the terrace of Restaurant 3. We invite you to save the date and stay tuned for full details coming soon.

For more information on the CERN MusiClub see here (https://club-musiclub.web.cern.ch/).

Reduction in the number of guards at Gates A and C

As of 1 June 2022, Gates A and C will no longer be staffed by guards at all times, but at certain times only on a random basis.

Use of these two gates by car will henceforth be limited to owners of duly registered vehicles (https://home.cern/news/announcement/cern/obligation-register-vehicles-driven-cern-site), who will have to place their access card against the card reader when entering the site.

The intercom system will continue to be available to allow communication with the security service in the event of problems.

10 June: CERN Alumni Virtual Company Showroom with Guardsquare

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

The event will start **at 11:00 CET on 10 June** with a general presentation and will be followed by a Q&A session, come armed with your questions.

Please register here (https://alumni.cern/events/88310) for the event to receive the zoom link.

About Guardsquare

Guardsquare provides mobile app security solutions to more than 800 customers worldwide. The company develops and supports a suite of mobile app security solutions, ranging from code analysis to obfuscation, in businesses across industries (financial services, e-commerce, gaming and media).

More information on the Alumni website (https://alumni.cern/events/88310).

Volunteer for CERN's summer activities at CineGlobe and Science Night

This summer, become a CERN ambassador on the Organization's activity stand at Science Night, and help host the 11th edition of the CineGlobe international film festival

CERN workshop at Science Night in 2018 (Image: CERN)

(https://cds.cern.ch/images/CERN-HOMEWEB-PHO-2022-100-1)

CineGlobe

From 29 June to 3 July 2022, the CineGlobe international film festival will be returning to the CERN Globe of Science and Innovation for its 11th edition. With open-air screenings of short and feature-length films inspired by science as well as virtual-reality experiences and hands-on workshops, CineGlobe promises to be a highlight of the summer.

Always a popular event for people from CERN and the local area, CineGlobe owes its growing success each year to its volunteers. From welcoming the visitors to running hands-on workshops for families and schoolchildren, their help is vital to make the event a success.

Become a CineGlobe volunteer! Sign up and find out more here (https://indico.cern.ch/e/cineglobe-2022-volontaires).

Science Night

On 9 and 10 July 2022, against the splendid backdrop of Perle du Lac park in Geneva, the Science History Museum is holding its 13th Science Night, on the theme "*Et pourtant...*" ("*And yet…*"). This event will allow participants to discover science in a friendly and festive setting.

CERN will be present, hosting a stand called "*Rencontre avec l'invisible*" ("*Encounter the invisible*"). The programme includes fun activities to enable old and young alike to discover the fundamental principles of physics and to celebrate the 10th anniversary of the discovery of the Higgs boson. We're looking for friendly and motivated volunteers to run the activities, including drawing, workshops, virtual reality, vortex cannon, etc.

Become a Science Night volunteer! Sign up and find out more here (https://indico.cern.ch/e/nuit-de-la-science-2022-volontaires)

Conditions of participation

No previous experience is required, and full training will be provided. The schedule will be drawn up based on your availability; there will be several shifts each day for each event. Please make sure that you:

- have a CERN contract (MPE, MPA, official CERN guides, ENTC, TEMC);
- are over 18 years of age;
- attend the compulsory briefing sessions;
- speak French proficiently (minimum B2 level, especially for Science Night).

Dress code and meals

- You will be provided with one or two CineGlobe or Standard Model formula t-shirts to wear, depending on the number of shifts you do.
- A meal voucher will be provided by the organisers if your shift includes a lunch or dinner break.

Volunteering is a great opportunity to see behind the scenes of a public event, represent CERN vis-à-vis the public and meet new people, so come and join the adventure by signing up!

Become a CineGlobe volunteer (https://indico.cern.ch/event/1162859/)

Become a Science Night volunteer (https://indico.cern.ch/event/1162608/)

Workshop on Resistive Plate Chambers and Related Detectors (RPC2022), 26—30 September

(https://cds.cern.ch/images/CERN-HOMEWEB-PHO-2022-090-1)

Registration for the RPC2022 Workshop, which will be held at CERN from 26 to 30 September 2022, is open on the event's Indico page (https://indico.cern.ch/event/1123140/) until 12 August 2022.

The workshop will focus on both the performance and possible upgrade scenarios of large RPC systems as well as applications outside the context of particle physics.

Abstracts for oral presentations and for posters can be submitted until 1 July 2022. Posters will be displayed in a dedicated session.

Information about accommodation and accessibility at CERN can be found on the Indico page (https://indico.cern.ch/event/1123140/).

For any questions, please contact rpc.2022@cern.ch or visit the webpage of the event.

2022 ECFA Workshop on Higgs/EW/Top Factories at DESY, 5–7 October 2022

The 2022 ECFA (European Committee for Future Accelerators) Workshop on Higgs/Electroweak/Top Factories will be held at DESY from 5 to 7 October (in-person attendance only). Plenary and parallel sessions will be organised, with both invited and submitted talks. A poster session is also planned.

Register on the webpage of the event, where you will also find details of the workshop and the structure of the scientific programme, as well as information about travel and accommodation. The registration fee is 165 euros before 15 September and 200 euros after that date (the fee includes two dinners).

You can submit your proposed contribution via the webpage before 30 June, indicating your preferred presentation mode (poster or talk).

Four cinema and discussion evenings to celebrate the 10th anniversary of the discovery of the Higgs boson

Screenings of the film Particle Fever in local cinemas and theatres will be followed by discussions with scientists about the present and future of research at CERN

(Image: CERN)

On 4 July 2012, CERN announced one of the greatest scientific discoveries of the 21st century: the ATLAS and CMS experiments had finally found evidence of the existence of the elementary particle that had been more sought after than any other since the 1960s, the Higgs boson. Following the discovery, Peter Higgs and François Englert received the Nobel Prize in Physics.

Now, CERN is celebrating the tenth anniversary of the discovery by organising, together with the local communes, a series of cinema and discussion evenings entitled *Particle Fever continues ... the Higgs boson was just the beginning*.

Particle Fever, a documentary by Mark Levinson, is an intimate portrait of six brilliant scientists seeking to unravel the mysteries of the universe in the run-up to the discovery of the Higgs boson. Each screening will be followed by a discussion with a group of CERN scientists, who will answer the audience's questions. How has the Higgs boson changed our understanding of the universe? What questions remain unanswered? What is the future of research at CERN? If these are questions you're eager to hear answered, come along for an enjoyable evening of lively debate!

Three events will take place in June, in Meyrin, Saint-Genis-Pouilly and Saint-Julien-en-Genevois. The highlight of the public celebrations will be an evening event at CERN's Globe of Science and Innovation at 5.00 p.m. on Sunday, 3 July, which will round off the 11th CineGlobe (https://cineglobe.ch/) science film festival.

Save the date!

To sign up and find out more, see voisins.cern (https://voisins.cern/en).

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Meyrin | Salle des Vergers: Wednesday, 1 June – 8.00 p.m. (in French)

Saint-Genis-Pouilly | Théâtre le Bordeau: Saturday, 11 June – 8.00 p.m. (in French)

Saint-Julien-en-Genevois | Ciné Rouge & Noir: Thursday, 23 June – 8.00 p.m. (in French)

CERN | Globe of Science and Innovation: Sunday, 3 July – 5.00 p.m. (in English)

Jardin des Particules: enrol your child for the 2022-2023 school year

(https://cds.cern.ch/images/CERN-HOMEW EB-PHO-2022-085-1)

It is still possible to enrol your child at the Jardin des Particules *crèche* (nursery school) or school for the 2022-2023 school year.

The Jardin des Particules welcomes about 100 children, divided according to their age:

- The *crèche* welcomes children aged 4 to 48 months (daily registration, 2, 3 or 5 days a week);
- The school welcomes children aged 4 to 6 years (full day and 5 days a week attendance).

Enrol your child on the Jardin des Particules website.

For more information, please contact:

- Marie Luz Cavagna (enrolment/information) : info.jdp@cern.ch
- Roberta Cavigliasso (management and educational information) : roberta.cavigliasso@cern.ch

To book an individual appointment to visit and discover the Jardin, please contact:

- info.jdp@cern.ch
- 0041 22 767 36 04 or 0041 75 411 34 16

Ombud's corner

Leadership – easier said than done

In his 2020 annual report, my predecessor in the Ombud's office asks a challenging question: "Why are relations with the hierarchy the number one source of conflicts reported to the Ombud's Office?"

Underlying this observation is another interesting question: "Why is it still the case today when our Laboratory has built a considerable offer (https://lms.cern.ch/) of high-quality management and leadership training?"

Reflecting on this, I would like to share with you some key findings of a very interesting research report (https://www.cipd.co.uk/Images/leadership_2014-easier-said-than-done_tcm18-8893.pdf) from the UK Chartered Institute of Personnel and Development (CIPD), which gives some leads, or at least may get our thinking going, on why demonstrating leadership, even when equipped with the required skills, is easier said than done.

By **taking a systems perspective rather than considering the capability of individual leaders**, the report outlines some organisational factors that may limit the ability of capable managers, even when equipped with specific knowledge and skills through training and experience, to exercise their management and leadership skills.

Let me present to you a few of those factors that resonate most in the Ombud's Office. And I hope this will prompt you to read the full report and see how it resonates for yourself, in your own practice of management.

Hierarchy and bureaucracy

Managers may be called upon to exercise leadership on one hand, while still having to respect a clear decision-making hierarchy on the other hand. Faced with these two – sometimes opposing – demands, managers may be discouraged from making their own decisions after they are reprimanded the first few times for taking the initiative.

Similarly, and because the best ideas about operational aspects come from those who do the job, managers should ideally be empowered to implement more efficient ways of working that are suggested by their teams. However, failure to allow time for forward planning reduces opportunities to seek bottom-up feedback. It may also cause managers to operate primarily in firefighting mode and apply directive management skills. Even managers who have had leadership training and development might find it difficult to reconcile the strategic direction from the top, on one hand, with the day-to-day needs and interests of their people, on the other.

The report also points out that classic hierarchy, where individuals defer decisions to the higher level in the hierarchy, may slow down collaborative working between groups or departments.

Another point in relation to hierarchy and rather heavy bureaucracy is that experienced managers who are expected to embrace and implement change quickly, without always being involved in shaping the direction of change, might themselves not buy into the purpose of the programme, projects or activities.

Finally, for organisations that regularly restructure and have a fast-moving change agenda, if the next round of changes is put forward before the previous programme settles, managers may feel they do not have enough time to learn new behaviours and to develop them amongst their staff.

Short-term, bottom-line focus

When performance management and promotion processes focus on task-related performance objectives, one can forget that the job of managers is radically different from completing operational tasks. The primary role of managers is **to organise and influence others**, and this requires a different set of skills. Nevertheless, if leaders know that they will be primarily judged on how well they meet their operational objectives, they may sometimes focus on hitting short-term performance targets rather than on empowering their staff.

If good performers are promoted into managerial positions without considering their leadership potential, or if good individual performance allows people to get away with poor behaviours, the efforts invested in training and development might not achieve their objectives.

Resource constraints also make it difficult for managers to remain flexible to staff needs, while some cost-cutting solutions only add more processes to manage (e.g. heavier reliance on associated members of the personnel, managing contractors, suppression/streamlining of centralised support services, etc.).

Individualism

In theory, middle and front-line managers should be achieving their objectives through managing people. However, in times of cost

cutting and competition for resources, individual choices are sometimes dictated by the "survival mode" in which they feel they operate. They may focus their efforts on what is likely to serve their individual interests and will not compromise delivery for staff empowerment.

If the performance management process itself reiterates the priority given to meeting operational objectives over developing people, and focuses on **individual performance**, it may also reinforce the need for managers to find flaws in their team members' performance rather than celebrating successes.

Sameness over diversity

The challenge for leaders and managers today is embracing workforce diversity. Diversity comprises not just differences in people's demographic characteristics but also in their work styles, individual motivations to come to work and opinions on the best way to perform their job.

Still, people management processes can inadvertently favour sameness over diversity. To avoid this phenomenon, objective and rounded assessment in the selection and rewarding process are needed, rather than allowing individuals to be picked based on unconsciously noted similarity between the assessors and the candidate.

Furthermore, **overly prescriptive frameworks may restrict the scope for discretion**. Although managers are instructed to consider staff behaviours when rating performance, those behaviours, considering the infinite range of individual behaviours in a diverse workforce, are difficult to measure objectively. This is why managers may have to rely on delivery targets to differentiate individual performance.

As a fully trained and experienced manager, you have, in theory, the capability to empower, motivate and engage your team. Still, if you experience difficulties doing so, it may be that organisational processes do not always give you the ability to apply those managerial skills in practice. It is worth reflecting on how these organisational factors may affect your practice of management, and on how you may limit their influence, in order to better fulfil your capability to manage.

Laure Esteveny

I want to hear from you – feel free to email ombud@cern.ch with any feedback or suggestions for topics you'd like me to address.

NB: If you would like to be notified about posts, news and other communications from the CERN Ombud, please register to receive the CERN Ombud news (https://e-groups.cern.ch/e-groups/EgroupsSubscription.do?egroupName=cern-ombud-news).