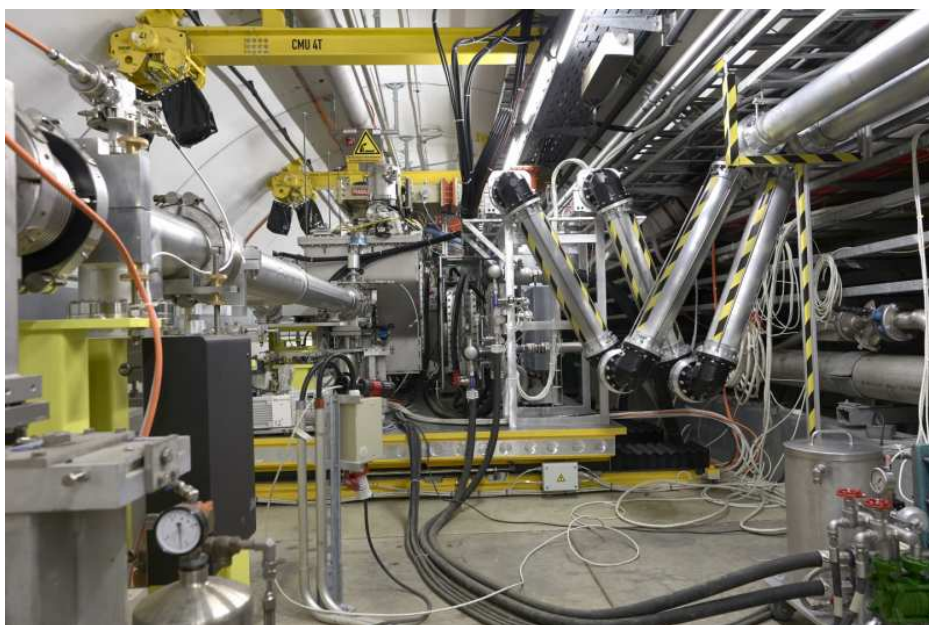


## WORLD'S FIRST CRABBING OF A PROTON BEAM

**CERN successfully tests crab cavities, a key component of the High-Luminosity LHC**



Test bench of the first two prototype crab cavities in the Super Proton Synchrotron (SPS) accelerator. The cryomodule containing the cavities is installed on a mobile table that allows it to be moved into the beam line as needed (Image: M. Brice/CERN)

The crab cavities, used to rotate the beams of protons, have been successfully tested on 23 May – a world first. The test took place using a beam from the SPS and showed that bunches of protons could be tilted using these superconducting transverse radiofrequency cavities. These cavities will play an important role to increase the luminosity in the HL-LHC, which will be commissioned after 2025 and will increase the luminosity of the LHC by a factor of five to ten.

In the LHC, the bunches of particles meet at a small angle at each collision point of the experiments. When installed at each

side of the ATLAS and CMS experiments, the crab cavities will “tilt” the bunches of protons in each beam to maximise their overlap at the collision point. In this way every proton in the bunch will be forced to pass through the whole length of the opposite bunch, increasing the probability of collisions and hence the luminosity. After the proton bunches have been tilted, their motion appears to be sideways – just like a crab. Crab cavities were already used in the KEKB collider in Japan for electrons and positrons, but never with protons, which are more massive and at significantly higher energies.

### A WORD FROM MARTIN STEINACHER

#### A FEW MINUTES TO SAVE YOURSELF HOURS

Mobility concerns us all. To find out just how much and to gather your ideas on how to help traffic in and around CERN flow more freely, the Mobility Working Group is launching a two-part survey. Part one is open for your input now. It will take around five to ten minutes to complete and I strongly encourage you to make the investment: your input now could save us all hours of commuting time in the long run.

*(Continued on page 2)*

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# A WORD FROM MARTIN STEINACHER

## A FEW MINUTES TO SAVE YOURSELF HOURS

In Geneva, some 40% of working people use a car to get to work, leading the State of Geneva to pursue an active mobility policy and encourage all major employers in the region to adopt more efficient and sustainable mobility practices. CERN's Mobility Working Group is responding to this need and has already implemented a number of measures, including the installation of green mobility equipment, a car sharing initiative and the introduction of radar speed signs to monitor road use at key points around the Laboratory. The group's main objective is to produce a CERN mobility plan outlining the mea-

sures to be implemented by 2030 to facilitate movement in and around CERN and encourage the use of efficient and sustainable modes of transport.

This is why the group is launching a survey. In order to improve mobility, we first need to understand it. Part one of the survey will identify the various mobility profiles for home-work commutes and professional travel among the people working on the CERN sites. It will feed into the second part of the survey, to be launched after the summer, which will ask you to evaluate the measures

proposed by the working group based on analysis of the answers to the first part. It's therefore very important that the first part of the survey receive responses from a strong representative sample of the CERN population to ensure that the measures proposed are effective. So please do take a few minutes to tell us about your experience and help improve mobility for all of us. Thank you very much!

To answer the survey, click here ([https://fr.surveymonkey.com/r/MP\\_CERN](https://fr.surveymonkey.com/r/MP_CERN)).

*Martin Steinacher*  
*Director for Finance and Human Resources*

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## WORLD'S FIRST CRABBING OF A PROTON BEAM

"The crab cavities are expected to increase the overall luminosity by 15 to 20%," explains Rama Calaga, leader of the crab cavity project.

The two first crab cavity prototypes were manufactured at CERN in 2017 in collaboration with Lancaster University and the Science and Technology Facilities Council (STFC) in the United Kingdom, as well as the U.S. LHC Accelerator Research Program (USLARP). The cavities were assembled in a cryostat and tested at CERN. They are made of high-purity niobium superconducting material, operating at 2 kelvins (-271 °C), in order to generate very high transverse voltage of 3.4 million volts. The cavities were installed in the SPS accelerator during the last winter technical stop to undergo validation tests with proton beams.

The first beam tests on 23 May lasted for more than 5 hours at a temperature of 4.2 K with a single proton bunch accelerated to 26 GeV and containing between 20 and 80 billion protons, almost the intensity of the LHC bunches. The crab cavities were powered to about 10% of their nominal voltage. The "crabbing" was observed using a special monitor to control the tilt along the length of the bunch. "These tests mark the start-up of a unique facility for testing superconducting cavities on a high-current, high-energy proton beam," explains Lucio Rossi, leader of the HL-LHC project. "The results are impressive and crucial to prove the feasibility of using such cavities for increasing the luminosity in the LHC."

In the coming months, the cavities will be commissioned to their nominal voltage of 3.4 million volts and will undergo a series

of tests to fully validate their operation for the HL-LHC era. A total of 16 such cavities will be installed in the HL-LHC – eight near ATLAS and eight near CMS.



*The first prototype of crab cavity has been assembled during the summer 2017 (Image: Julien Ordan/CERN)*

# LHC REPORT: RUNNING TOWARDS A PRODUCTION BREAK

The LHC is in full production mode with 2556 bunches per beam and has already successfully provided 14.6 fb<sup>-1</sup> to each of ATLAS and CMS



Quarter 2 of the 2018 LHC schedule, indicating the machine development block, the technical stop and the special run period.

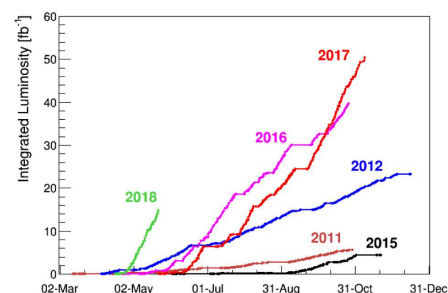
In a couple of weeks the first block of machine development days will start, during which the machine is available to the various experts and specialists to perform tests, as well as machine and beam studies. These studies are generally aimed at improving the performance of the LHC and preparing for the HL-LHC, but also at better understanding observed phenomena, such as beam instabilities, etc. This will be followed by a four-day technical stop to perform the necessary maintenance not just on the machine, but also on the experiments.

A one to two day technical stop recovery normally brings the machine back to production performance, but the experiments, through the LHC Programme Committee,

have decided to perform a series of special runs that are also part of the LHC physics programme. During the first of these, so-called van der Meer scans will be carried out in the experiments. These aim to calibrate precisely the luminosity measurements provided by the experiments. To do this, the injectors will prepare a high quality beam with a reduced number of bunches that will be injected, accelerated and collided in the LHC. The beam position in the experiments will then be scanned, separating the beams more or less. Doing so in the horizontal and vertical planes, we can establish an absolute luminosity measurement to which the values of the luminosity measurement system can then be compared.

The second of the special runs consists of running with un-squeezed beams with a  $b^*$  of 90 m, meaning that the angle of the particles will be very low. In other words, the particles are travelling in a much more parallel fashion, allowing special physics to be carried out by CMS and TOTEM, as well as by ATLAS and ALFA.

Once these special runs are completed, normal operation will resume, again in luminosity production mode. These periods of machine development, technical stops and special runs will create plateaus in the curves of integrated luminosity, but these are already taken into account in the luminosity forecast that aims at 60 fb<sup>-1</sup> in 2018.



Unlike the other curves, so far no real plateaus can be observed in the integrated luminosity curve of 2018. This will change soon with the upcoming machine development days, technical stops and special runs. However, after those the pace should pick up again.

Rende Steerenberg

## A DIFFERENT PERSPECTIVE OF CERN

Discover the new aerial photos of CERN taken by drone at [gis.cern.ch](http://gis.cern.ch). You'll be amazed by the level of detail



The new drone in action. (Image: SMB-SE-DOP/CERN)

From an altitude of about 100 metres, the drone recently acquired by the Design Office and Patrimony service (SMB-SE-DOP) took over 6200 aerial photos of CERN's Meyrin and Prévessin sites in two

days. The images were then put together using the principles of photogrammetry in order to produce orthophotos (photos geometrically rectified in order to create 2D maps). You can find them at [maps.cern.ch](http://maps.cern.ch) and [gis.cern.ch](http://gis.cern.ch). The level of detail, as you'll see, is remarkable. The resolution is 1.5 cm per pixel, between four and ten times the previous level of precision.

Before the service acquired the drone, photos were taken from a plane in the framework of a partnership between CERN and the SITG, the Geneva geographical information system. These photos, which are still used in areas outside the fenced part of the CERN site, offer a lower resolution of 6 to 15 cm per pixel and are updated only every two to four years, not enough to

build up a real geomatics tool like the one available today. To keep the maps up to date, the Design Office and Patrimony service intends to photograph the CERN sites every year. These updates will also play an important role in documenting the history of CERN.

"The incredible precision of the photos means that we are now able to create maps directly from digital photos of objects such as road markings, curbstones and manholes," explains Youri Robert, the geomatics engineer in charge of the service. "Using these images we can make digital elevation models (DEMs) virtually automatically, with a topographic accuracy of better than 3 cm in the case of hard surfaces. This saves a huge amount of time

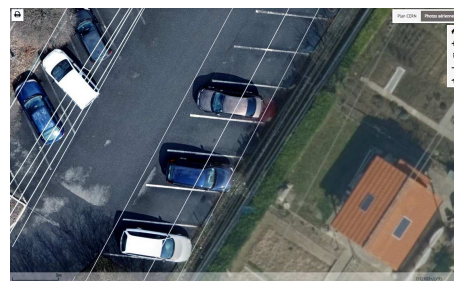


when it comes to producing topographic drawings for preliminary design studies.” These digital models are also used to calculate the volume of material in large-scale earthworks, such as those for the HL-LHC project, and so to check how much earth has been excavated and stored without having to physically inspect the worksite.

“In manual mode, the drone also allows us to inspect or explore areas that are hard to access, such as roofs, facades, the water tower and electrical power stations. By getting extremely close to the object we’re studying, we can produce photos with a very high resolution of 1 or 2 millimetres

per pixel”, continues Youri. “We have also acquired a heat camera to be able to check insulation and assess the impact of renovation work.”

Discover the new aerial photos of CERN at [maps.cern.ch](https://maps.cern.ch) or [gis.cern.ch](https://gis.cern.ch) or, if you require your own aerial photos, send a request to “Drone Mapping”.



Left, the car park on route Bohr photographed by the new drone. Note the difference in the resolution compared to the old aerial photo of the house and fields outside the fenced part of the CERN site. (Image from [maps.cern.ch](https://maps.cern.ch))

Anaïs Schaeffer

## DEFINING TECHNOLOGY FOR TOMORROW'S EXPERIMENTS

**More than 450 physicists and engineers took part in the first workshop to define CERN's experimental programme from 2020 onwards**



Physicists and engineers have begun to define CERN's R&D programme on new experiment technologies from 2020 onwards. (Image: CERN)

The scale and technological sophistication of the detectors at the LHC experiments is almost incomprehensible. In addition to several subdetector systems, they contain millions of detecting elements and support a research programme for an international community of thousands of scientists. The volume of data that will be produced during the high-luminosity upgrade of the LHC (HL-LHC) and by future colliders calls for even more sophisticated technologies.

In November 2017, CERN launched a process to define its R&D programme on new experiment technologies from 2020 onwards. The programme covers detector upgrades beyond HL-LHC and includes concepts developed for the Compact Linear Collider (CLIC) and the

Future Circular Collider (FCC) study. The first workshop took place at CERN on 16 March and more than 450 physicists and engineers, about half of whom are visiting scientists hosted by the laboratory, took part.

Beyond the HL-LHC, experiments may evolve in different directions. Therefore, the aim is to launch an R&D programme that concentrates on advancing key technologies rather than developing specialised applications. Developments in detectors for high-energy physics also benefit many other sectors, from healthcare and medical imaging to industry and quality monitoring, so it is timely to think how industry can be involved in joint R&D efforts.

Detector improvements envisioned for the 2020s and beyond include better electronic readout, modelling and simulation tools, and better computational techniques for reconstructing the recorded information. Increased timing accuracy to mitigate event pile-up in very high-luminosity environments will almost certainly impact the development of all classes of detectors, whether silicon, gas or photodetectors. The challenges of the HL-LHC and future colliders also places tough requirements on readout electronics and fast data links, while advances in data processing and storage are equally important.

Participants also discussed the special facilities and infrastructures needed to test chips under realistic conditions – presenting an impressive number of options on advanced materials, design tools and production technologies, which could change how detectors are built and boost their performance. R&D into magnet design for future colliders also demands progress in superconducting materials and cables to meet strict strength and cost requirements.

The talks at the March workshop covered a variety of topics reflecting CERN's diversity and strong collaboration with commercial and academic partners worldwide. They demonstrated that new concepts, manufacturing tools and materials, combined with the development of simulation tools and software, can open a new era in detector technologies.

A second workshop will take place this autumn to review progress.

*This article is based on an article published in the May issue of the CERN Courier.*

Panos Charitos

# MOBILITY: WE NEED YOUR HELP!

**By responding to a survey about how you travel to, from and around CERN, you will help new mobility proposals to be drawn up**

Do you often find yourself stuck in a traffic jam on your way to work? Are you interested in car-sharing but worried how you'd make it to the dentist's at lunchtime? Have you given up hope of ever finding a parking spot less than 100 metres from your office? Are you looking for new ways to simplify your journeys to and from work? If so, this survey is for you!

The mobility working group, which was set up in 2017, is launching a two-part survey designed to help to improve the situation.

The first part is aimed at **establishing people's habits and needs**. Please take five minutes to complete the survey to make sure that your profile is taken into account. The survey is designed for everyone who travels to the CERN site, from members of the CERN personnel to users, contractors' personnel, students, apprentices and fellows.

Your answers will provide crucial input for **new mobility proposals**, which will be the

subject of the second part of the survey, in September.

Please complete the survey **by 20 June** by clicking here ([http://fr.surveymonkey.com/r/MP\\_CERN](http://fr.surveymonkey.com/r/MP_CERN)). The results will help you to save time and energy in the future!

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*See also the Word from Martin Steinacher, Director for Finance and Human Resources.*

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## COMPUTER SECURITY: ANOTHER WAY OF MAKING MONEY WITH ADS

**One major source of revenue on the Internet is advertisements. Interestingly, not only honest companies have embarked on online advertising...**

One major source of revenue on the Internet is advertisements. One view, one hover of your mouse, one click: everything is counted and converted into money paid by the advertisers to the owners of the website where the ad is displayed. This is not bad per se as it provides visitors with "free"\* content while still maintaining a revenue stream for the content providers. Interestingly, not only honest companies have embarked on online advertising, but the evil side has also discovered advertisements to spread their malware.

As outlined in a previous article ("Malware, Ransomware, Doxware and the like"), attacking end-user computers is a multi-billion dollar business run by professional, but illegal, enterprises. Many different attack vectors are employed, such as phishing e-mails, malicious attachments, or targeted attacks against companies and their employees. Or attackers even try to infiltrate major websites and hide malware within. If an unfortunate user accesses that website, his or her vulnerable computer is compromised and his or her private life is gone (see our article on "Drive-bye").

Alternatively, the malicious evil-doers just buy themselves into one of the big advertisement network distributors ("ad networks", see [https://en.wikipedia.org/wiki/Advertising\\_network](https://en.wikipedia.org/wiki/Advertising_network) for examples) and hope that their malicious advertisements ("malvertisements") are properly distributed and shown on major websites. Superficially, their malvertisements promote fake products or services. Behind the scenes, however, the malvertisement tries to exploit vulnerabilities in your web browser, its plugins, or in your operating system.

Although the ad distributors generally do a good job of blocking such malvertisements, it's a cat and mouse game. Malvertisements might affect major legitimate and popular websites: news outlets, public transport webpages, feeds in Facebook or Twitter, etc. In such cases, our motto "Stop – Think – Don't click!" can't be applied. Instead, it is of the utmost importance that you keep your operating system and all applications, in particular your web browser, up-to-date. Make sure that the respective update mechanism is set to "auto-

matic" so that your devices download and apply fixes as soon as possible. If available, install and run antivirus software and remember that CERN's antivirus software for Windows computers and Macs is free for you to also use at home. Good luck!

\*The "free" has been put in inverted commas as, unfortunately, advertisements nowadays often come with tracking algorithms that monitor your activity and try to gather more information about you and your computer (e.g. your location, keyboard language, operating system type). If you don't like this, consider using ad blockers or browser extensions for more privacy.

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*Do you want to learn more about computer security incidents and issues at CERN? Follow our Monthly Report. For further information, questions or help, check our website or contact us at [Computer.Security@cern.ch](mailto:Computer.Security@cern.ch).*

*The Computer Security Team*

# Official communications

## EDUCATION FEES - PERIOD OF ADMISSIBILITY

Members of the personnel are reminded that, pursuant to Article R V 1.37 of the Staff Regulations, they have until 31 August 2018 to submit claims for the reimbursement of education fees relating to the 2016/2017 school year.

These claims should be made via group or department secretariats.

As of the 2017/2018 school year, claims should be made using a new EDH form, which should be completed directly by the beneficiary: [https://edh.cern.ch/Document/Education Fees](https://edh.cern.ch/Document/EducationFees)

Detailed information concerning education fees is available in the

Admin e-guide: <https://admin-eguide.web.cern.ch/procedure/paiement-des-frais-deducation-sommaire>

The Human Resources department also remains at your disposal to answer any questions: [schoolfees.service@cern.ch](mailto:schoolfees.service@cern.ch).

*HR department*

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## FAMILY BENEFITS - OBLIGATION TO PROVIDE INFORMATION

Members of the personnel are reminded that, pursuant to Articles R V 1.38 and R V 1.39 of the Staff Regulations, they are obliged to declare the following in writing to the Organization within 30 calendar days:

- any change in family situation (marriage, civil partnership, birth or adoption of a child, divorce, death of a spouse or dependent child);
- any change in the situation of a dependent child (end of studies, start of paid employment, military service, marriage or civil partnership, change of residence or dependence status of a spouse's child);

- the amount of any financial benefit of a similar nature to those stipulated in the Staff Regulations (e.g. family allowance, child allowance, infant allowance, non-resident allowance or international indemnity) to which the member of the personnel or a family member may be entitled from a source other than CERN.

The procedures to be followed are available in the Admin e-guide: <https://admin-eguide.web.cern.ch/en/procedure/change-family-situation>

The Human Resources department also remains at your disposal to answer any questions: [HR-Family.Allowance@cern.ch](mailto:HR-Family.Allowance@cern.ch).

Members of the personnel are also reminded that any false declaration or failure to make a declaration with a view to deceiving others or achieving a gain resulting in a financial loss or loss of reputation for the Organization constitutes fraud and may lead to disciplinary action in accordance with Article S VI 2.01 of the Staff Rules.

*HR department*

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## 120TH ACCU MEETING

**Agenda for the 120 th ACCU meeting to be held on Tuesday, 5 June 2018 at 9:15 a.m. in Room Georges Charpak (Room F, 60/6-015)**

1. Chairperson's remarks
2. Adoption of the agenda
3. Minutes of the previous meeting
4. News from the CERN Management
5. Report on services from SMB Department
6. Report on services from IT Department

7. The CERN Ombudsperson
8. Staff Association and the links with Users
9. Users' Office News
10. Matters arising
11. Any Other Business
12. Agenda for the next meeting

The **Advisory Committee of CERN Users (ACCU)** is the forum for discussion between the CERN Management and the representatives of CERN Users to review the practical means taken by CERN

for the work of Users of the Laboratory. The mandate of ACCU is available on: <http://accu.web.cern.ch/content/mandate>

There are one or two Delegates from each Member State (two Delegates from the large Member States), one Delegate from each of the Associate Members, four Delegates from non-Member States (NMS), and two from CERN. The list of ACCU members is available on: <http://accu.web.cern.ch/content/accu-members>

ACCU meetings are attended by the Director General and members of the Directorate, other members of the CERN management and departmental representatives, the Head of the Users' Office and a representative of the CERN Staff Association. Other members of the CERN

Staff attend as necessary for specific agenda items.

**Chairperson:** Dragoslav-Laza Lazic  
(Dragoslav.Lazic@cern.ch)  
**Secretary:** Michael Hauschild  
(ACCU.Secretary@cern.ch)

Anyone wishing to raise any points under "Any Other Business" at the upcoming ACCU meeting is invited to contact the appropriate User representative, or the Chairperson or the Secretary.

## Announcements

### EASISCHOOL: SCHOOL ON APPLIED SUPERCONDUCTIVITY - APPLY NOW!

EASITrain, a Marie-Curie EU innovative training network, organizes a school on applied superconductivity in collaboration with the European Society for Applied Superconductivity (ESAS) and the Technical University of Vienna (TUW). The school will run from 3 to 14 September 2018 in Vienna, Austria.

EASISchool offers a broad set of lectures and courses, delivered by top experts, covering different disciplines related to superconductivity and cryogenics. Dr Georg Bednorz, Nobel Prize in physics in 1987,

will give an insight seminar on the evolution of superconductors.

The school targets doctoral students with knowledge and experience in superconductivity and cryogenics. It is also open to postgraduate students and researchers with related experience.

The registration fee is 200 € . It includes all lectures and more! Participants will enjoy a rich social programme of opportunities for networking, including the visit of

the Atominstitut (nuclear reactor and superconductivity lab), a very limited number of places to visit the MedAustron, particle-accelerator based cancer treatment facility, and the social dinner at one of the most famous Austrian traditional tavern restaurants.

Take part and register! <http://easischool.web.cern.ch/>

Registration deadline is August 1st, 2018. Apply Now!

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### CERN LOCKS AND KEYS SERVICE: NEW EXTENDED HOURS

As part of its ongoing efforts to improve its services, the SMB department is pleased to announce that from 1 June 2018, the Locks and Keys service will be open all day

Monday to Friday from 7.30 a.m. to 5.30 p.m. We hope that this change will meet your needs.

*SMB Department*

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### ACCESS YOUR PERSONAL DOCUMENTS ON THE HRT APPLICATION

The Personnel Accounting service would like to remind you that the following personal documents can be accessed via your personal access (PER) to the HRT application, if applicable:

- "PAY INFO":

- Current pay slips under "CURRENT YEAR"
- Pay slips from previous years under "ARCHIVE"
- Annual internal taxation certificates under "TAX CERTIFICATES"

You can activate your "PER" access via the icon representing a grey cog in the top right-hand corner of HRT desktop and then clicking "ACCESS SELECTION".

*Finance and Administrative Processes department*

# Ombud's corner

## “WOMEN NEGOTIATE POORLY, LACK SELF-CONFIDENCE AND ARE RISK-AVERSE.” REALLY?

This stereotype is often trotted out to explain the lack of equality between men and women in the world of business, but recent research completely disproves it. The differences between the sexes are actually far better explained as the result of a set of practices and habits ingrained in business culture, rather than by the differences between men and women themselves. Simply put, people react differently according to the situations they're placed in.

Among the factors that foster success in business are access to information networks, tolerance of mistakes and quality of feedback. Studies show that, in most companies, women fare much less well than men in these areas. Everyone, male or female, behaves more cautiously when they have fewer opportunities. But it's easier to say that women just aren't as good at their jobs...

The fact that women are given fewer networking opportunities than men reduces their chances of succeeding in negotiations. One study gives the example of Mary and Rick, who both have the same job in a financial services firm. Rick sits on the board of another firm, which gives him access to more information about investment opportunities than Mary, who hasn't had the chance to meet high-level external partners.

Many studies also show that tolerance of mistakes is much lower for women than for men, and their punishment more severe. The slightest mistake made by a woman is paraded for all to see, while for men, companies tend to focus only the positives, turning a blind eye to any mistakes. So should we be surprised that women tend to take fewer risks?

Women also seem to receive less feedback than men, for whom it's more direct

and regular. It's therefore harder for them to correct any problems as they go along, which can lead to surprises during the annual performance interview. Is it any wonder, then, that women struggle more with self-confidence?

To fix this imbalance, companies must first recognise that it exists. Then, they must identify the root cause of the differences in how men and women are treated. We all expect to be treated the same way.

*Pierre Gildemyn*

*If you'd like to comment on any of my articles or suggest a topic that I could write about, please don't hesitate to e-mail me at [Ombuds@cern.ch](mailto:Ombuds@cern.ch).*

*Note: this article is a summary of one that appeared in the May-June 2018 issue of the Harvard Business Review.*