

## WHERE WERE YOU? YOUR HIGGS STORIES REVEALED



Standing ovation in the CERN auditorium at the end of the seminar announcing the discovery of the Higgs boson.  
(Image: Maximilien Brice, Laurent Egli/CERN)

The first time you hear world-changing news is always memorable. The discovery of the Higgs boson was one of the most important discoveries in science to date, and it happened in our lifetime. If you were part of the particle physics community or were interested in the research, you can undoubtedly answer straight away: Where were you when you heard?

On 4 July 2012, Fabiola Gianotti, the ATLAS spokesperson, and Joe Incandela, the CMS spokesperson, announced that their experiments had found a particle consistent with the long sought-after Higgs boson.

The news generated a wave of emotion among the science community and made headlines around the world.

We asked you to share with us your memories of the day. Thanks to everyone who submitted their story. We can only publish

a few, but you can share more on social media using the hashtag #HiggsStories or add your own to the comments on the CERN Facebook page.

### Humanity and camaraderie

"I loitered around the Main Auditorium after they had filled the seating area. Surprisingly, three of us were called in at the very last second and I was placed in the first row, in front of Lyn Evans and Chris Llewellyn Smith! [Editor: Lyn Evans was the Head of the LHC project during the construction and commissioning phase and Chris Llewellyn Smith is a former CERN Director General.] In the picture, I am the gentleman who Fabiola is shooing out of the way to congratulate both of them. Perhaps the most amazing part of the entire experience was just how much humanity and camaraderie was displayed.

(Continued on page 2)

### A WORD FROM THE DIRECTOR GENERAL

#### HAPPY BIRTHDAY HIGGS BOSON!

Five years ago today marked a significant moment in the history of particle physics. Many of us were in the CERN auditorium. Many more, almost a billion people around the world, watched the seminar remotely.

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# A WORD FROM THE DIRECTOR GENERAL

## HAPPY BIRTHDAY HIGGS BOSON!

What a day that was, the culmination of years of hard work by thousands of physicists, engineers and technicians, and what a long way we've come since then. Back on 4 July 2012, both ATLAS and CMS were nudging the 5-sigma threshold required to announce the discovery of a new particle. Taken together it was clear that we had a wonderful discovery on our hands. Nevertheless, our language was rightly cautious. CERN's press release went out with the title: CERN experiments observe particle consistent with long-sought Higgs boson. That's hardly earth-shattering language, but the global media were a little bit more upbeat, as I recall.

The initial discovery was based on a sample of just a few hundred Higgs candidates for each experiment. That was enough to tell us that a Higgs-like particle existed, and that it had a mass of around 125 GeV, but not much else. It was our first glimpse of a fascinating new physics landscape waiting to be explored. Five years on, the exploration is well under way. We have thousands of Higgs bosons in our data samples now.

With this new data, ATLAS and CMS have made excellent progress in measuring the properties of the new particle, and understanding how it couples to a range of fundamental particles.

The Higgs boson is not just another particle; it is special and profoundly different from all other elementary particles observed so far. And the Brout-Englert-Higgs mechanism is remarkably linked to the least known part of the Standard Model and to some of the most important outstanding problems in particle physics today (flavour, naturalness, vacuum stability). Thus, the discovery of the Higgs boson opens new paths of exploration, provides a privileged door into new physics, and calls for a very broad experimental programme which will extend for decades. Over the coming years, the LHC experiments will continue to measure the properties of this particle with increasing precision, they will search for rare, exotic and forbidden decays, and they will look for additional Higgs bosons. It has been a fascinating five years, and we're still just at the beginning.

The Bulletin this week asks: 'where were you the day the Higgs boson discovery was announced?' Well, I will never forget where I was. I was in the CERN auditorium where I had the privilege of presenting the result of the ATLAS experiment, together with Joe Incandela representing CMS, on behalf of the thousands of people who had contributed for years to the development, construction and operation of the unprecedented LHC accelerator, detectors and computing. It will forever be a highlight of my life. Happy birthday Higgs boson!

Read more about the discovery of the Higgs boson (<http://home.web.cern.ch/about/updates/2017/06/happy-5th-anniversary-higgs-boson>) and read the stories of how people experienced the event (<http://home.web.cern.ch/cern-people/updates/2017/06/where-were-you-your-higgs-stories-revealed>).

Fabiola Gianotti  
Director-General

## WHERE WERE YOU? YOUR HIGGS STORIES REVEALED

When the CERN Director General asked if anyone had anything to say, I could hear Lyn Evans and Chris Llewellyn Smith behind me: 'You should say something', 'No, YOU should say something'. It was a truly humbling moment."

*David W. Miller, ATLAS physicist from the University of Chicago*

### A new birth

"The day the Higgs was announced, I was at home 40 weeks pregnant looking forward to making my own discovery of the year: motherhood! But I really remember well plugging my computer into a projector and watching the webcast on a big screen, so it would feel more like I was in the main

auditorium with everyone. I felt very proud of all of us for this great achievement."

*Anne-Marie Magnan, CMS physicist from Imperial College, London*

### 26 years to complete my task

"I began my research career on 4 July 1986 at Harvard University, in the US, with Carlo Rubbia. Professor Rubbia liked to have group meetings on national holidays in the US. My first project was to look for the decay of a Higgs into gamma gamma in the UA1 experiment's data. Exactly 26 years later we announced the discovery of a Higgs to gamma gamma and my group was part of the CMS team doing that analysis. It only took 26 years to the day to

complete the project that Professor Rubbia assigned me on my first day,"

*Colin Jessop, CMS Physicist from the University of Notre Dame*

### Champagne at breakfast

"I was in the CERN auditorium, after getting in line around 2am. Even then I was in one of the last rows. I think that day is the only time I've ever had celebratory champagne for breakfast. Completely worth it though to stay up all night, now I have an amazing story to share!"

*Stephanie Hamilton, was a CERN summer student in 2012 and is now a PhD student in astronomy*

## We are the champions, my friends

"I thought it would be tough to miss the most tantalising seminar at CERN during my time in particle physics. But I was lucky to be at DESY, where they broadcasted the event in the main auditorium. The auditorium was packed, everyone was excited and impatiently waiting to see the results of the two experiments—the atmosphere was similar to a public screening of an international football tournament final. And when Rolf Heuer finally concluded that he believed we had a discovery, it felt like seeing the deciding goal: big applause and great joy from everyone!"

*Christoph Rembser, CERN physicist for the ATLAS experiment*

## Pyjama party

"I was one of many who attended the 2 am (local time) simulcast of the CERN presentations announcing the Higgs Boson, at Fermilab, outside Chicago, in the US. Two things made it especially memorable. First, the announcement of the nighttime event jokingly mentioned that pyjamas were optional (I thought my faux fur tiger robe might be appropriate for the festive occasion). Secondly, my 16-year-old son, Thomas, showed great interest and decided to join me. It's been a pleasure since to watch his interest in physics grow, as he continues to work on neutrino and dark matter physics after completing his undergraduate studies."

*William Wester, scientist at Fermilab*

## The discovery turns into reality

"After a sleepless month (I worked in the CMS diphoton channel and on the final combination of all Higgs searches), on 4 July 2012 I left CERN around 2am after helping prepare the CMS presentation for the seminar. Then, during the morning, I was in the main auditorium, live tweeting for CMS. Many people ask me when the Higgs boson was discovered, usually thinking that I'll say something about the CMS data. In fact, for me, the discovery happened upon seeing the ATLAS results and realising we hadn't made a mistake ourselves."

*Andre David, CERN physicist for the CMS experiment*

## How I became Higgs' bodyguard

"On day two of my new job at CERN, I was asked if I would be willing to look after Professor Higgs on 4 July 2012, around a seminar to announce the latest results from the ATLAS and CMS experiments. Well, what would you say? Just before the seminar began, Professor Higgs was escorted to the packed auditorium. The media went mad, surging forwards. There were TV camera operators jostling for the best position, alongside journalists with audio recorders and microphones. It was astounding – this unassuming, very private, octogenarian was being treated like the latest teen pop sensation!"

*Stephanie Hills, Communications officer at STFC*

Read her full account here (<http://www.stfc.ac.uk/news/my-day-with-professor-peter-higgs-by-steph-hills/>)

## Chasing me that far

"I was in Shanghai, on vacation. That morning the *Shanghai Daily* newspaper was displayed at the entrance to my hotel's restaurant. CERN and the Higgs boson chased me that far!"

*Marc Tavlet, Engineer at CERN*

## In the sky

Many physicists found themselves in the air at the time, on a flight to Australia for the ICHEP conference. All the latest results from the LHC experiments had to be presented at this major particle physics conference. But, two weeks before the conference, it was decided that the Higgs discovery would be announced at a seminar at CERN. Some physicists didn't hear about the result until they landed, a somewhat bittersweet moment, as some had been working towards the result for decades.

"I was on a plane to Melbourne to take part in the ICHEP conference."

*Dario Barberis, ATLAS physicist from INFN*

## Kind but unhelpful

"I was attending ICHEP in Australia. I found myself sitting next to a reporter from the Australian Associated Press. I chatted with her a bit; she was a general news reporter with no science background and a little worried about how to cover this story. The next day, I found this article online. It wasn't how I had planned to make the news. But I

will say that the words "kindly" and "unhelpful", which describe me in the article, also appear frequently on my teaching evaluations."

*Ken Bloom, CMS physicist from the University of Nebraska-Lincoln*

## The Higgs in Hindi

"I was in a tea shop in the city of Kanpur, India. In front of me a person was reading a newspaper and my eyes were drawn to an image of the ATLAS detector. Then I gradually realised the article was about the discovery of the elusive Higgs boson. I returned home to find on every news channel on TV were stories about the Higgs discovery. The next day, I woke up early to buy newspapers—every paper, whether it was in English, Hindi or Urdu, had a headline about the Higgs discovery."

*Mohammad Ibrahim Mirza – a physics Masters student in 2012, he is now applying for a PhD in the CMS experiment.*

## So lucky to be here

"It was the summer before the beginning of my university studies, and I was working as a summer helper at a factory, building industrial air conditioners. Throughout the day I followed the news coverage of the announcement on my phone, whenever I had a moment to spare, hoping that one day I could at least visit CERN, where they were discovering the secrets of the Universe. Today I still can't believe how lucky I am to get to do research for my PhD here."

*Joona Havukainen, PhD student in the CMS experiment*

## In the middle of nowhere

"I was travelling in the Canadian Rockies in a camper van with no access to email or news, disconnected from anything that was going on in the world and absorbed by our adventure. On a wet 4 July 2012 we made a stop to refuel in a small petrol station in the middle of nowhere. There, lying on the plastic tables in the cafe, were local newspapers with CERN and the Higgs Boson announcement making headlines."

*Anna Cook, CERN HR professional*

## Rewriting history

"It happened during the period when I was writing my first short and educational book, *AstroParticelle* on cosmic rays. Due to the good news, I had to rewrite a whole paragraph."

*Marco Arcani, science writer in Italy*

### A genius in my family

"I was working as a TV producer, in Lisbon. When I arrived at the studio the next day everyone was joking, congratulating me because 'I had genius in the family'."

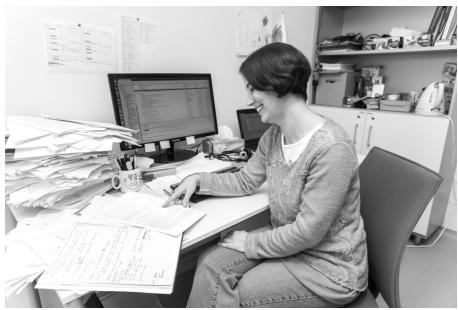
*Ana Higgs, TV producer in Portugal*

Read more about the discovery of the Higgs boson (<http://home.web.cern.ch/about/updates/2017/06/happy-5th-anniversary-higgs-boson>).

You can share your story of 4 July 2012 on Twitter using the hashtag #HiggsStories or add your own to the comments on the CERN Facebook page.



David is shown in the bottom left in beige, ducking out of Fabiola's way. (Image: Maximilien Brice, Laurent Egli/CERN)



Anne-Marie works in Building 40 and shared more about her day-to-day work for our In Practice series. (Image: Sophia Bennett/CERN)



The buzz around the announcement was like that of a Lord of the Rings movie premiere, or the final Harry Potter book, with people queuing from the early hours to guarantee their seat to witness history. The queue wound its way from the auditorium on the first floor, down the main building staircase, through the cafeteria and out to the dining hall. (Image: Maximilien Brice/CERN)



Stephanie Hamilton celebrated the discovery with Champagne at breakfast with her colleagues. (Image: Stephanie Hamilton)



At the DESY laboratory in Hamburg, physicists gathered in the main auditorium to watch the live webcast of the Higgs discovery announcement. An attentive audience before the explosion of joy. (Image: DESY)



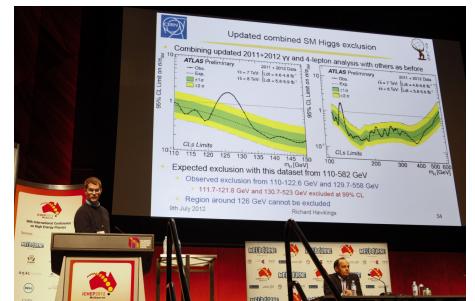
Despite the event taking place in the middle of the night on a US national holiday, a lot of scientists made their way to the Fermilab auditorium to watch the webcast of the seminar taking place at CERN, 7000 km away. William Wester (first row with his tiger robe) and his son were among those participating in this very special pyjama party. (Image: Fermilab)



360° photo of the auditorium during the Higgs seminar. Andre David appears in the middle of the second row, with a red shirt. (Image: Maximilien Brice/CERN)



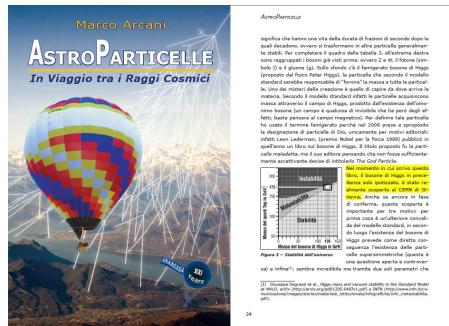
At the beginning of the press conference, which followed the seminar presenting the results. Peter Higgs cannot be seen for the cameras and microphones surrounding him. (Image: Achintya Rao/CERN)



Peter Higgs escorted by Stephanie Hills (on the right) escapes the room where the press conference has just happened. (Image: Achintya Rao/CERN)



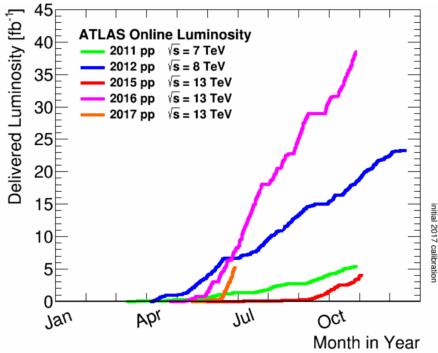
Physicists from ATLAS (photo) and from CMS presented their results later that week at the ICHEP conference in Melbourne. (Image: Claudia Marcelloni/CERN)



Newspapers around the world covered the story, the Press Office collected as many as possible.

Corinne Pralavorio and Harriet Jarlett

## LHC REPORT: FULL HOUSE FOR THE LHC



The integrated luminosity as a function of time for the different years of LHC operation. 2016 was a record year and although we did not yet accumulate much luminosity in 2017, it looks promising as the slope is the steepest of all years.

Now the skies have cleared for the LHC and the electron clouds have been reduced, the intensity ramp up continued, stepping up the number of bunches to 2556 bunches per ring, with a formal confirmation that the collider and its sub systems were functioning at each step. On Wednesday 28 June 2017, the two beams in the LHC collided, with 2556 bunches each. This is presently the maximum we can inject and bring into collision.

This has led to some new records for the LHC:

- The peak luminosity reached  $1.58 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$  – a good 10% more than the 2016 record of  $1.4 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$ , and also 58% more than the design value.
- The 2556 bunches, combined with an intensity of  $1.15 \times 10^{11}$  protons per bunch at 6.5 TeV, means the stored beam energy has reached 300 MJ per beam.
- Very good machine availability has also allowed a record accumulation of integrated luminosity of  $0.7 \text{ fb}^{-1}$  in 24 hours.

The target for the integrated luminosity in 2017 is  $45 \text{ fb}^{-1}$  and on the 28 June more than  $6 \text{ fb}^{-1}$  have been integrated by each of the general-purpose experiments ATLAS and CMS.

The standard LHC beam production and filling scheme foresaw 2808 bunches per ring with 288 bunches per injection from the SPS, and each bunch containing  $1.15 \times 10^{11}$  protons in a beam size of 3.5 micrometres. But, since 2016, a new beam production scheme called Batch Compression Merging and Splitting (BCMS) was developed, which is of much higher brightness. It still contains the  $1.15 \times 10^{11}$  protons per bunch, but the beam size is reduced to around 2.5 micrometres. When the beam density from the injectors

increases, the number of collisions in the LHC also increases, hence the luminosity increase.

More dense beams also mean more energy per surface unit, hence this beam could potentially cause more damage to equipment in case that it is lost (for example, in the transfer lines between the SPS and the LHC). Because of this the maximum number of bunches is limited to 144 bunches per injection from the SPS. This, in combination with the gaps between batches for the injection kicker rise times, which was also optimised and brought down from 225 ns to 200 ns, results in the maximum of 2556 bunches per ring.

This week the LHC will not be filled with particles, but the tunnel will be occupied by many people performing maintenance on the machine and its subsystems, during this first one-week technical stop of 2017.

When the machine restarts after the technical stop, the aim is to consolidate the luminosity production with the maximum number of bunches. The next step is then to gradually explore the margins by increasing the intensity per bunch, hence pushing the luminosity even further.

Rende Steerenberg for the Operations group

# COMPUTER SECURITY: SUMMER STUDENTS, HOLD ON A MINUTE

Summer has arrived. And with it, 2017's summer students. Welcome to CERN! Ahead of you are two months of great lectures, challenging projects, the possibility to expand your network of peers... and lots of fun! In order to make sure that the fun lasts to the end, here is a small plea from the CERN Computer Security team to you and your supervisor.

CERN runs an open IT environment like you might be used to at your university. You can bring your own computers/tablets/smartphones and hook them up to our Intranet. A CERN e-mail address will be assigned to you. You can launch your own personal homepage hosted by CERN. You can instantiate virtual machines and play around with your pet IT project. Lots of freedom, lots of flexibility. But this does not imply that CERN is the Wild West. Please note that CERN has a set of Computing Rules, which define the extent of your freedom and flexibility. They usually stop where the operations and reputation of the Organization are at stake. So the browsing or downloading of illegal, unethical or offensive web content is not permitted. This includes pornographic material of any kind. Running software illegally or using pirated licence keys for software installed on your computer or a computer used by you is also not allowed. CERN has encountered some problems with this in the past (see our article "Do you have 30 kCHF pocket

money?". Furthermore, please refrain from sharing music, videos, films, games or software with your peers, friends and families while using CERN's networks. Generally speaking, such file sharing is considered to be a copyright violation in various ways in different European countries, including in the two CERN host states, and can affect our reputation in a negative way (see "Music, Videos and the Risk for CERN"). Last, but not least, any political, commercial or profit-making activity, if not related to your CERN duties, should be managed from outside the CERN network and should not use any CERN resources (e-mail addresses, websites, etc.). Just be reasonable!

Finally, if you happen to be working on a project linked to IT, like developing software, designing a webpage, deploying a database... please do not try to reinvent the wheel. We have seen too many brilliant developments fail after the originator left CERN and the project was left in limbo. So if you are working on a project developing code, get the appropriate training first so that your software is "free" of bugs and vulnerabilities that may spoil the functionality of your code and your program. If you have been asked to set up a database or a web server, consider the solutions offered by CERN's IT department first (the full catalogue is available here: they provide a database-on-demand service as well as

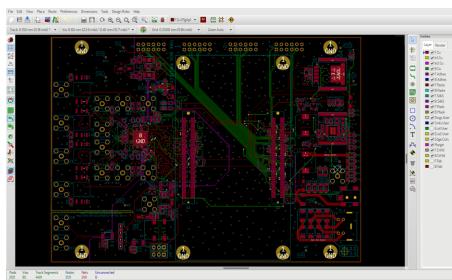
various web services for free. No need to mess around with hardware, operating systems, web servers and the like – simply create your webpages! Also note that the use of external services (i.e. web services outside CERN) is not recommended from a computer security perspective. If you have any doubts or need help designing and structuring the computing part of your project, get in touch with us at Computer.Security@cern.ch. For those of you who are engaged in mathematical simulations, engineering tasks or the design of control systems: CERN provides a portfolio of engineering applications for free. There is no need to download additional software from the Internet. If you do need to, contact Software.Licences@cern.ch first, as that software might come with licence costs or may violate the copyright of third parties.

With those few reasonable basics in mind: enjoy your time at CERN!

*Do you want to learn more about computer security incidents and issues at CERN? Follow our Monthly Report ([http://cern.ch/security/reports/en/monthly\\_reports.shtml](http://cern.ch/security/reports/en/monthly_reports.shtml)). For further information, questions or help, visit our website (<http://cern.ch/Computer.Security>) or contact us at Computer.Security@cern.ch.*

*The Computer Security Team*

## KICAD REACHES NEW HEIGHTS



A screenshot showing a layout of an analog-to-digital converter board (Image: Maciej Sumiński/CERN)

Sharing designs and information around the world is one of CERN's key philosophies, and one small group in particular has spent five years contributing to the de-

velopment of KiCad, an efficient tool for designing open-source hardware.

Created 25 years ago at the Grenoble Institute of Technology, today KiCad evolved to the most popular free and open-source software for the design of printed circuit boards (PCB), allowing electronics engineers from different laboratories around the world to share their designs.

Tomasz Włostowski, Maciej Sumiński and Javier Serrano, members of CERN's beams department, joined the KiCad community five years ago and have been contributing to the development of the software ever since.

The financial contributions the team receive through the CERN & Society Foundation, as well as the dedication of the team developing the software, have been crucial to its success (the Foundation's annual review for 2016 (<https://giving.web.cern.ch/content/publications>) shows individual online donations funded more than 130 hours of development on various work packages).

This support, as well as the hours of hard work, meant the group was able to build in many new, useful features to the software. One of them is the integrated simulator support, which allows users to run a simulation after completing the design, to verify that their circuit board works as they expected.

"Another thing we accomplished thanks to the Foundation's support was to make a unified geometry library. This is an engine calculating the proper distance between tracks and zones on the printed circuit board. Thanks to that, we now hope to improve the design rules checker, so that we can use more complex tools to define what is valid for a board," explains Tomasz.

A lot of work has also been put into remaking the KiCad engine. This is 'under the hood' work that is not directly visible for the users, but is essential for maintenance and future improvements of the pro-

gram. Currently more work is being done on what users actually see. "Soon we will start working with professional designers. The goal is to get their feedback to find out which parts of KiCad should be improved," explains Maciej.

The team will also take the symbol and component libraries that have been developed at CERN for other tools and convert them to a format suitable for KiCad. "The CERN library symbols are used to draw schematics and footprints. They represent the physical circuit board components, like chips and resistors. Implementing them to

KiCad will be a huge boost for the community because they were designed by the CERN technical drawing office so are of extremely high quality."

If you want to join the effort to enhance KiCad, and to ensure that design and development knowledge flow more freely, you can help by making a donation (<https://giving.web.cern.ch/civicrm/contribute/transact?reset=1&id=6>) to the CERN & Society Foundation.

Iva Raynova

## FCC WEEK 2017: DIVERSITY FUELS PROGRESS



Participants on the first day of FCC week 2017 (Image: Sophia Bennett/CERN)

In June FCC week 2017 was held in Berlin. Jointly organised by CERN, DESY and the German Physics Society (DPG), it brought together more than 500 researchers from 147 institutes to review the progress in every domain of the Future Circular Collider (FCC) study. Participants had the opportunity to get an overview of the ongoing activities, learn about the latest developments and exchange ideas in a stimulating environment.

FCC is a vibrant international collaboration, as reflected by the high number of participants and their age distribution; there has been a marked increase in the number of under 26-year-olds present. The diversity of the attendees extended beyond age

and is a key strength of the collaboration, as everyone's different backgrounds bring unique perspectives to the project, accelerating its progress. In recognition of this, the organisers of FCC Week presented seven participants with the Accelerating Diversity Prize, to encourage underrepresented groups and support gender equality in our international scientific environment.

The conference boasted a rich and intense scientific programme with 250 presentations and 50 posters, covering a wide range of topics, from detector and magnet design, to physics opportunities for each scenario and civil engineering. We even covered the economic impact of CERN accelerators. The first day opened with reports on the conceptual machine design for the three future collider scenarios, FCC-hh, FCC-ee and FCC-eh, and also included a comprehensive overview of international projects hoping to build the next generation of particle colliders. On Wednesday, two young researchers received the FCC Innovation Award for their outstanding work on the mitigation of electron cloud effects and on a simulation tool to optimise the reliability of a large collider. This year's winner are Eleanor Belli (Sapienza University, Rome) and Jussi-Pekka Penttinen, a doctoral student at Tampere Technical University, also

working for Ramentor. Their work highlights new concepts and technologies with significant impact to the FCC-study.

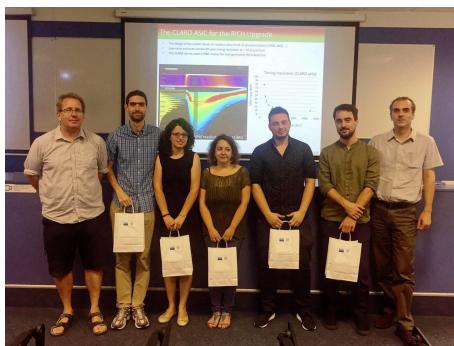
In the final talk of the week, Michael Benedikt, programme leader for the FCC study, highlighted that, following the presentation of the most exciting technological and scientific advances of the previous year, the focus of the FCC Collaboration is now on preparing the Conceptual Design Report, set to be published by the end of 2018.

In line with FCC's mission to bring the science of particle accelerators closer to the public and showcase the social value of fundamental science, an open exhibition was organised in parallel with the conference. The public was invited to embark on an interactive journey, blending sound and video art with artefacts from CERN and DESY, to explore how particle accelerators work, discover the history and achievements of the LHC and learn about plans for future colliders.

Mark your calendars for FCC Week 2018 in Amsterdam!

Panagiotis Charitos

# LHCb EARLY-CAREER SCIENTIST AWARDS



From left to right: Guy Wilkinson, spokesperson for the LHCb Collaboration, Giulio Dujany, Lucia Grillo, Elena Dall'Occo, Renato Quagliani, Claudio Gotti, and Patrick Robbe (chair of committee). (Image: LHCb Collaboration)

Twenty-nine nominations were submitted and considered by the committee, and on 16 June 2017 five prizes were awarded for work that had a significant impact on the

operation of the LHCb experiment within the last year.

The recipients are:

- **Elena Dall'Occo** for the evaluation and assessment of the silicon sensors that will be used in the upgrade of the LHCb VELO detector. These measurements led to the choice of the sensor technology and vendor for the VELO upgrade.
- **Giulio Dujany** contributed to the real-time alignment and calibration of the vertexing and tracking system of the LHCb experiment. This led to stable and precise alignment of the detector, allowing to achieve the best possible performances for physics analyses.
- **Claudio Gotti** worked on the development of the CLARO chip, the front-

end ASIC of the LHCb RICH detector upgrade. This was a key element of the success of the RICH upgrade design.

- **Lucia Grillo** played a leading role in the development and operation of the online real-time calibration and alignment of the LHCb tracking system. This is now part of the daily running of the LHCb experiment, and is a crucial step towards the operation mode foreseen for the LHCb detector upgrade.
- **Renato Quagliani** developed a new seeding algorithm for the tracking software of the LHCb detector upgrade. This algorithm shows a large gain in efficiency to find low momentum tracks, a corresponding reduction in fake-track rates and a faster execution time.

Patrick Robbe for the LHCb Collaboration

## COMPLETION OF CIVIL-ENGINEERING WORK FOR BUILDING 311



On Friday, 30 June, Lluis Miralles, head of the Site Management and Buildings department, and José Miguel Jiménez, head of the Technology department, alongside all the project leaders and contractors involved, took part in a ceremony to mark the end of the civil-engineering work for Building 311.

The work was completed fully on schedule thanks to the exemplary coordination between the external contractors and various

CERN services. A number of aesthetic and functional improvements, for the comfort of the building's future users, were made during the work.

The next phase of work on the building by the EN-CV, EN-EL and IT groups has already begun, which will allow the building to be delivered as planned at the end of 2017.

Anaïs Schaeffer

## CERN ACCELERATOR SCHOOL: VACUUM FOR PARTICLE ACCELERATORS



The CERN Accelerator School course titled "Vacuum for particle accelerators" attracted 80 participants from 27 nationalities. (Image: CERN)

The CERN Accelerator School (CAS), in collaboration with Max IV Laboratory in Lund, Sweden, organized a specialized course titled "Vacuum for particle accelerators". It took place in Glumslov, Sweden, from 6 to 16 June 2017.

The course attracted 80 participants from 27 nationalities, coming from countries as far away as Canada, China, Jordan, Russia and the USA.

The intensive programme comprised 30 hours of lectures and 17 hours of practical work. The lectures covered material properties, impedance and instabilities, gauges and pumps, surface properties and

treatments, beam induced effects, computational techniques and controls, manufacturing and acceptance, and a look to the future. The practical work provided hands-on experience of Molflow+, impedance calculations, mechanical and material aspects, residual gas analysis and leak detection techniques. The students also pursued an exercise based on one of the tutorials, presenting their results on the final afternoon.

A full-day visit to the Max IV laboratory and the European Spallation Source (ESS) laboratory, with seminars in the morning and visits to the facilities in the afternoon, was included in the programme. The students also had the opportunity to visit the Kronborg Castle and the Louisiana Museum of Art in Denmark.

The next CAS course will be on advanced accelerator physics and will be

held in Egham, United Kingdom from 3-15 September 2017. In addition, a Joint Accelerator School on radio-frequency technologies will be held at Hayama, Kanagawa, Japan, on 16-26 October 2017.

Further information on forthcoming CAS courses can be found on the CAS website (<https://www.cern.ch/schools/CAS>).

Barbara Strasser

## NEW ARRIVALS



On Thursday 29 June 2017, recently-recruited staff members and fellows participated in a session in the framework of the Induction Programme. (Image: Sophia Elizabeth Bennett/CERN)

## AN ARTIST'S VIEW OF CERN



You might see Laura Couto Rosado around CERN while she conducts research and builds art as part of her Collide Pro Helvetia prize (Image: Sophia Bennett/CERN)

Laura Couto Rosado sees CERN as an ideal place to be inspired by science and to produce new works of art.

"My practice as a designer is inspired not only by natural phenomena but also by the sciences that study them and the technologies that emerge from them. I use the basic principles of applied physics to develop intriguing hybrid design products." This is how the designer Laura Couto Rosado describes her work. Laura won the "Collide Pro Helvetia" prize, which is organised by Arts at CERN in partnership with the Swiss Arts Council "Pro Helvetia".

The Collide Pro Helvetia prize, established in 2012, allows Swiss artists to spend three months at CERN seeking inspiration from scientists and the world of science. After her first month at CERN (June), Laura will take a short break from her residency over the summer, resuming in September. She talks enthusiastically about her experience of working at CERN so far: "CERN and its arts programme provide a perfect framework for me to refine and enhance my artistic method, the aim of which is to make design and science even more symbiotic. So far, it's going very well," she confirms. "I came to CERN with preconceived ideas for my project. The knowledge that I'm acquiring through my meetings with physicists exceeds all my expectations, and it is driving me to steer my research in a more refined, subtle and creative direction. For now, the best way for me to approach quantum phenomena is to let the physicists express themselves by focusing on their own experiences, giving lots of detail and using their own metaphors, even at the risk of losing the thread of my own ideas."

Physicists are the second secret to the success of the Arts at CERN programme, as the artists interact with genuine physicists directly, not through an intermediary or a

filter. Laura seems to particularly appreciate this aspect: "I'm lucky to have James Beacham as my scientific partner. He's open and attentive; he suggests ideas for me to explore and provides me with the tools to develop my project." She continues: I'm also very pleased with the meetings I've had with other CERN physicists. I really appreciate their generosity."

CERN will no doubt leave a strong impression on Laura and her work as an artist, and she's equally determined to make her mark on CERN before she leaves, especially on the physicists with whom she's interacted. "Concretely, through my 'Flavourful Objects' project, by the end of my residency I'd like to have put in place the basis of a vocabulary and a methodology that would allow designers to explore formalisation techniques influenced by the world of quantum physics. It would be a souvenir to thank the physicists as well as a way of monitoring the evolution of 'Flavourful Objects'".

Antonella Del Rosso

# CERN SIGNS AGREEMENT WITH ITALIAN BUSINESS EDUCATION PARTNER



To the right of CERN Director-General Fabiola Gianotti, John Elkann, Vice Chairman, Agnelli Foundation and Chairman, FCA and Silvia Petocchi, Director of SAFM (Image: Sophia Elizabeth Bennett/CERN)\*\*

A new agreement with partner SAFM (*Scuola di Alta Formazione al Management (SAFM)* – Institute of Higher Education in Management – in Turin, Italy) will stimulate and reinforce CERN's entrepreneurship activities.

SAFM, a non-profit private enterprise, is supported and promoted by the Fondazione Giovanni Agnelli, Fondazione Edoardo Garrone and Fondazione Pirelli, together with the Association of Collège des Ingénieurs from Paris. It specialises in business education and innovation management and provides a series of entrepreneurial programmes.

The agreement provides the framework for an ensemble of collaborations on the theme of entrepreneurship and manage-

ment. On one side, CERN will become a technological and operational partner for SAFM projects, and on the other, SAFM will assist CERN in creating new relationships with industry partners, incubators and potential investors. The collaboration will involve several CERN initiatives, including the Knowledge Transfer group, IdeaSquare and the CERN & Society Foundation.

CERN and SAFM have already successfully collaborated on entrepreneurship programmes, for example the Innovation for Change (I4C) project, launched in February 2016 at IdeaSquare in CERN.

In 2016, the I4C rewarded the business ideas developed by 50 SAFM MBA students as well as graduate students of the Polytechnic of Turin. The ideas had to be based on credible innovative solutions, using available technologies to address global collective needs so that real startups could provide market solutions. The groups of interdisciplinary students – in the fields of business, tech and design, pitch their start-up ideas to a jury. In June 2016, AquaSmart, a smart grid system to help identify and solve water leakages, was announced as the winner of the Innovation for Change project.

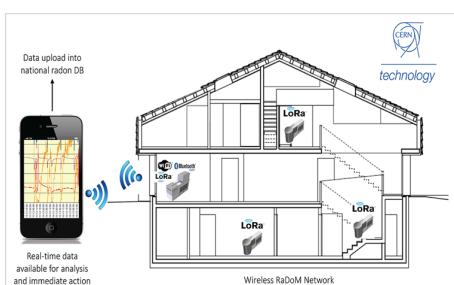
In 2017, I4C launched its second year programme, and will end with another start-up pitch competition at the SAFM & CDI Innovation Summit, held a few days after the agreement signature. This year's I4C jury includes Charlotte Lindberg Warakaulle, CERN Director of International Relations, as well as members of the SAFM board of directors.

Find out more about CERN's Entrepreneurship activities on the KT website.

\*\*From Left to Right: Raghu Movva, Project manager of SAFM; Andrea Gavosto, Director of the Agnelli Foundation; Andrea Griva, Head of innovation area of the Agnelli Foundation; Silvia Petocchi, Director of SAFM; John Elkann, Vice Chairman, Agnelli Foundation and Chairman, FCA; Fabiola Gianotti, CERN Director-General; Charlotte Warakaulle, CERN Director for International Relations; Roberto Losito, CERN Engineering Department Head; Giovanni Anelli, CERN Knowledge Transfer Group Leader.

Anaïs Rassat for the KT group

## HOW TO BUILD RADON SMART SENSORS BASED ON CERN TECHNOLOGY



Concept of the RaDoM network. Long-term, real-time radon monitoring for schools, work places & buildings (Image: CERN)

The Radon Dose Monitor (RaDoM) project, whose aim is to create a device to tackle

the risks of high radon levels, has made it to the final round of the MassChallenge 2017 Start-up Accelerator Programme, which has the goal of helping start-up businesses succeed by providing resources such as mentoring, networking events, and office space.

Radon, a natural radioactive gas, is a colourless and odourless gas produced as part of natural decay processes. However, the gas is also hazardous and poses a risk when it accumulates in buildings, particularly in enclosed spaces such as lofts or basements. Pre-emptively monitoring the gas level in homes, workplaces, schools and other public buildings is therefore cru-

cial. However, many currently available radon measurement systems are inefficient, expensive or can only be operated by experts. In addition, without sharing or compiling the data in an archive, health and government authorities encounter a lot of difficulties in properly monitoring geographical trends.

Using the Swiss National Radon Action Plan 2012-2020 as a guide, the RaDoM device will combine radon sensors, new software, and Wi-Fi, Bluetooth and Lora connectivity options to produce an appliance that is better connected, more efficient and provides faster data analysis. It also complies with newly-introduced radon-limiting

European legislation, which aims to reduce radon exposure risks.

Thanks to the funding from the AIDA-2020 Proof-of-Concept and the CERN Medical Applications funds, the RaDoM team will work in conjunction with Politecnico di Milano to develop a network of smart sensors based on CERN technology for monitoring radon. The participation to the MassChallenge 2017 has the goal of setting up a CERN spin-off company named SmartSensors to develop this device and software.

Whilst authorities (such as public health offices) will be able to monitor the radon levels via the central database, direct users will have access to radon data in real-time using mobile applications, and later a web interface. This will allow basic mitigation actions to be triggered when radon concentration exceeds the reference values.

Francesco La Torre, future CEO of the SmartSensors spin-off company and a Radiation Protection Physicist at CERN, details his experience in the first round of the challenge, "I gave a pitch at Campus

Biotech in Geneva in front of an expert panel of six judges and the feedback was overwhelmingly positive."

The project was selected from 450 applicants for the first stage of the MassChallenge Switzerland 2017 start-up accelerator. It was then selected as one of the 75 Swiss finalists, and will officially join the programme as of 19<sup>th</sup> June 2017.

Jennifer Toes

## MUSICIAN HOWIE DAY RECORDS LOVE SONG TO PHYSICS



Singer Howie Day recorded a parody version of his song 'Collide' at CERN. Watch the video below. (Image: Noemi Caraban Gonzalez/CERN)

Singer-songwriter Howie Day was sitting in a coffee shop in Denver one morning while on tour, when he saw in his Twitter notifications CERN had shared a parody video of his hit song "Collide", sung from the perspective of a proton in the Large Hadron Collider. After a brief exchange on Twitter, he decided to record the parody himself, and make a new video during a visit to CERN. You can watch it below.

Sarah Charley, US communications manager for the LHC experiments, had come up with the idea for the original parody video. She created it with the help of graduate students Jesse Heilman of the University of California, Riverside, and Tom Perry and Laser Seymour Kaplan of the University of Wisconsin, Madison.

Heilman, now a postdoctoral researcher at Carleton University, explains why they saw the song as a gateway, to reach out to people beyond academia.

"All of us have been steeped in the science for so long that we sort of forget how to use normal language," he says. "It's always important for academics and researchers to learn different ways to communicate what we're doing, because we're doing it for people and for society."

"There's a point in the original song where there's an emotional build," Heilman says. "Day sings, 'I've found I'm scared to know, I'm always on your mind.' Our parody uses that part of the song to express the hopes and fears of experimentalists looking for evidence that might not ever appear."

"We're all experimentalists, so we're all searching for something," he continues. "The feeling is that [the theory of] supersymmetry, while it's this thing that everybody's been so excited about for a long time, really doesn't seem that likely to a lot of us anymore because we're eliminating a lot of the phase space. It's sort of like this white whale hunt. And so our lyrics, 'Can

SUSY still be found?' is this emotional cry to the physics."

"I was flattered, and it was quite funny, too," Day says of seeing the video for the first time. "I immediately retweeted it and then sent a direct message inquiring about a visit. I figured it was a long shot, but why not?" While at CERN, Day made a new music video for his re-recording of the parody song.

Day, who says he has always been fascinated by the "why" of things, had been aware of CERN before this project, but he had only a rough idea of what went on there. He says that it wasn't until he got there that things started to make sense.

"Obviously nothing can prepare you for the sheer scale of the place, but also the people who worked there were amazing," says Day. "I felt completely overwhelmed and humbled the entire time. It was truly great to be working at the site where humans may make the most important scientific discoveries of our lifetime."

*This is an excerpt from a longer piece, which you can read in Symmetry magazine. Watch the original parody video.*

# Announcements

## WANT TO BE AN EARLY ADOPTER? GADGETS PROVIDED!

IT regularly introduces major upgrades of the services it provides. Usually those upgrades introduce new features and sometimes completely new tools are offered.

If you would like to be informed about new or upgraded tools and services provided by IT and have a chance to test them even before they are publicly released, then we will be happy to welcome you on board.

We currently offer the possibility to test phone calls and collaboration features of Skype for Business (\*). We will give a "Logitech H570e" headset to the first 30 people that agree to switch their office phone (Alcatel) to Skype for Business in the coming few weeks.

Skype for Business is an application that provides:

- Phone calls
- Chat
- Remote desktop sharing

- Point-to-point video calls

It is especially convenient for people moving around (meetings, business trips, working from home, working from outside the office). But it's useful also for people working in an office for:

- Initiating phone calls from a PC, for example from a browser (phonebook.cern.ch), from Outlook etc.
- Being hands-free during a call
- Easy way to configure forwarding of calls (also while being out of the office)
- Getting your own phone number including notifications for missed calls and voice messages (useful for people sharing a phone number)

Interested?

Join the "Early Adopters" community, state your interest and claim your prize on the channel! Anyone with a CERN account can

join the community. Simply join the "Early adopters" channel on the Mattermost portal by following those steps:

1. Join the "IT-dep" team on Mattermost (<http://cern.ch/go/zl6h>) (you don't have to work for IT department to join!)
2. Join the "Early Adopters" channel (<http://cern.ch/early-adopters>)

IT Department

(\* ) *Skype for Business lets you activate a CERN fixed phone number on your CERN account. It can be installed on Windows, Mac, mobiles/tablets (Android, iPhone, Windows phone) and the Pidgin application for Linux can also connect to the service. Skype for Business is CERN regular telephony system. All new phone numbers are activated on Skype for Business.*

## BLOOD DONATION | 18-19 JULY 2017, 09:00-16:00, R2

### BLOOD DONATION

Tuesday 18 & Wednesday 19 July 2017  
from 9.00 to 16.00 - CERN, Restaurant n°2 (Build. 504)



# THE CERN HARDRONIC MUSIC FESTIVAL IS BACK THIS JULY



The CERN Hardronic Music Festival is back! On 15 July, ten of the finest MusiClub bands plus a DJs set will come on stage to amuse the crowd on its 26<sup>th</sup> edition. The show will run from 3 p.m. to 1 a.m. with performers acting alternatively on two

stages behind Restaurant 3, so the music never stops. A bar, a stand for food and second-hand stall (all for charity) plus the legendary free bouncy castle for kids will ensure you have a great time.

Entrance is free for CERN members. Their friends and relatives will have to be registered in a guest-list available in the festival's website. A free shuttle service will take people from CERN reception to the festival area in Prévessin. For more information regarding visitors and other practical informations, please check <http://cern.ch/hardronic>.

The festival can only take place thanks to the volunteers helping us run it. If you want to take part in this great collective effort, please send an e-mail to [hardronic@cern.ch](mailto:hardronic@cern.ch) and help us make an even better festival!

The MusiClub would like to thank the CERN Staff Association and CERN Management for their continued support, without which this event could not take place, as well as the SMB department, the ECO group and the IT department.

## EARLY-CAREER RESEARCHERS IN MEDICAL APPLICATIONS AT CERN

EARLY CAREER RESEARCHERS IN MEDICAL APPLICATIONS@CERN  
SHORT TALKS  
7 JULY 16:00 COUNCIL CHAMBER  
Cern.ch/verna

FEATURED RESEARCHERS  
Baptiste Baudot  
Ricardo Gómez  
Ricardo González  
Giovanni Paganini

In this seminar, four CERN Fellows and Doctoral Students will showcase the diversity of medical applications that arise from technologies developed at CERN.

State-of-the-art techniques developed for particle accelerators, detectors, and physics computing have many applications beyond the high-energy physics community. One area of medicine that can utilise CERN's technologies and expertise

is hadron therapy, a rapidly developing technique for tumour treatment. However, for devices to be appropriate for medical use, there are often significant design challenges to overcome.

One of the talks will report on the MEDeGUN project, which aims to design an electron gun to be used in an Electron Beam Ion Source (EBIS) designed to serve as a C<sup>6+</sup> injector for LINAC-based hadron therapy facilities.

Also focusing on LINAC technologies for hadron therapy, there will be a presentation about the 750 MHz Radio Frequency Quadrupole, also known as the miniature accelerator, and the TULIP project.

Detection systems are a key component of any imaging system and the links be-

tween HEP and PET are longstanding. The newest research work on scintillating crystals for PET developed at CERN will be reported on.

We will also hear the latest news from BioLEIR, a project which explores the possibility of transforming the Low Energy Ion Ring (LEIR) accelerator into a multidisciplinary, biomedical research facility.

The topics are indeed fascinating and diverse, please come along and find out more!

Attendance is open to all without registration. If you require a CERN access card please contact us as indicated on the seminar page (<https://indico.cern.ch/event/645681/>).

## THE SUMMER STUDENT LECTURES START ON 27 JUNE

The prestigious 6 week Summer Student Lecture Programme will start on Tuesday 27 June. The lectures are accessible for

anyone at CERN, don't miss this opportunity!

The programme can be found at: <http://summer-timetable.web.cern.ch/summer-timetable/>.

# Obituaries

## VINOD (NICK) CHOCHAN (1949 - 2017)



*White board in the Bhabha Atomic Research Centre (BARC) in Mumbai (India) with messages of condolence from Nick Chohan's former colleagues, who worked with him on testing the LHC superconducting magnets in the SM18 test facility. "It was indeed a big shock to all of us who worked at the SM-18 test facility to hear about the untimely death of Dr. Vinod Chohan. We had a small get together to share our reminiscences with him. About 32 of our colleagues from Bhabha Atomic Research Centre (BARC) Mumbai attended. He was such a pillar of support for each one of us. We will miss him very dearly." - Mr. Daniel Babu*

Nick came to CERN first in 1975 as a fellow, then went to SIN (today PSI) near Zürich. In 1980 he returned to CERN, as a machine-supervisor at the PS-Division's Operation Group. At that time, the construction of the Antiproton Accumulator (AA, the world's first machine to produce, accumulate and store antiprotons) was just finished and the team who had built it was busy with its running-in. The purpose of the AA was to supply antiprotons to the SPS, for it to function as a proton-antiproton collider. This needed to be done in an operational way and Nick became a prominent

member of the AA operations team. His speciality was the controls aspects of the highly complicated processes within the AA and for the transfer of the antiprotons to the SPS. Simon van der Meer, inventor of stochastic cooling, on which the AA was based, had written himself practically all the software, of course in a highly sophisticated style. Nick became the only one to fully understand it and later extend it to the Antiproton Collector (AC) and convert it for integration into the PS controls system.

When, in 1991, the PS Beam Diagnostics (BD) Group was founded, he was the natural choice to become the Section-Leader for Systems Integration with the PS controls. In 1996, when the high-energy, collider part, of CERN's antiproton programme was terminated, Nick took on the additional responsibility of PS Divisional Safety officer.

Then, in 2002, he became heavily involved in the LHC project. Nick moved to the Accelerator Technology (AT) Division, where he led a team that first tested an LHC prototype-sector and then all of the 1706 superconducting bending magnets. CERN manpower was insufficient, but a collaboration with India, managed by Nick, made it possible.

Once the LHC became operational, Nick returned to his old affinity with antiprotons, now at the low-energy end of the pro-

gramme, as editor of the ELENA Design Report.

In 2014, the 65-year bell rang in his retirement. But for Nick, that was not a reason to stop work at CERN. He joined the CERN Scientific Information Service and provided highly welcome help on accelerator physics literature, photographic documentation and articles for Wikipedia.

Throughout his years at CERN, we all knew Nick as a friendly, easy-going man, always helpful and dedicated in his typical competent manner.

We are deeply moved by his sudden disappearance and shall hold on to the memory of the many good moments and years of collaboration and friendship that we shared with him.

### *His friends and colleagues*



# Ombud's corner

## STEPPING OUT OF OUR COMFORT ZONES

Taking on new tasks or responsibilities may sometimes be challenging, as they require us go beyond the familiar or 'comfort zone' and expose ourselves to scrutiny in an area where we are not immediately at ease. Stepping out of our comfort zones may take courage and additional effort but the stakes are high as this is ultimately what will allow us to avoid stagnation and grow towards our full potential.

*Sarah congratulated Dan and Sasha, two of her group members on having successfully built an extremely complex piece of equipment within schedule and to the full satisfaction of the user-clients.*

*Sasha clapped Dan on the back saying, "We did it, mate" but Dan's response of "No thanks to your attitude!" immediately wiped the smile off his face, and he left the room looking very shocked.*

*"What was that all about?" asked Sarah.*

*Dan explained that Sasha had complained throughout the whole project, constantly worrying that they did not have the necessary resources and expertise to complete the task in time, whilst at the same time*

*holding up progress by repeating all the tests and double-checking everything. "I know that the techniques we were using were new to Sasha", he said, "but his negative attitude only made things more difficult, even for himself. He needs to have more self confidence".*

*"You do understand why he does that, don't you?" asked Sarah, "it is probably a defence mechanism that he uses when he feels a little out of his depth. You do the same every time you ask me to repeat the steps of the procedure that we need to follow in our project".*

*"But that is a very detailed step by step procedure that I simply don't remember because I don't work with it every day" says Dan, "its not that I am being negative, I just want to make sure that I get the sequences right".*

*"How is it that you work with complex algorithms every day but you can't remember this procedure? Could it be that, like Sasha, you find yourself working on something that is not in your usual domain and you do not want to risk getting it wrong?" Have you considered that Sasha's com-*

*plaining and your alleged memory loss may both be examples of the same thing?*

Defence mechanisms such as these are strategies that we have developed over time in order to remain in our comfort zones and avoid facing new or difficult challenges in the workplace. Stepping out of one's comfort zone in the work environment may cause anxiety or embarrassment, which in turn generates a stress response. This may take the form of defence mechanisms that range from denial ("I don't remember") or rationalization ("we don't have the resources/expertise") to over-compensation (repeatedly testing and double-checking), all of which ultimately result in limiting our performance and effectiveness.

Whilst defence mechanisms of this kind can sometimes be useful, it is up to us to recognize them for what they are and reflect on whether they are worth keeping or whether they are actually keeping us from achieving our full potential. In the final analysis they are simply learned behaviours, which can be replaced by others – it is just a matter of deciding whether we want to step out of our comfort zones and allow ourselves to grow.