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LS2 REPORT: GETTING READY FOR THE FUTURE OF PHYSICS IN THE EAST AREA

Upgraded beam lines will support existing and new collaborations in an environmentally savvy manner in one of CERN's oldest facilities

Upgrades in the East Area are turning the facility into a state-of-the-art research centre (Image: CERN)

The East Area may have been inaugurated more than 50 years ago, yet it is still as modern as can be: just as it did in the 1960s, the smaller of CERN's two main experimental facilities for fixed-target physics and test beams, now packed with cutting-edge equipment after a four-year-long makeover, embodies the future of physics in terms of research, technology and the field's relationship with its environment.

Outer shell, floors, cooling systems, power converters and, of course, magnets – the renovation works left nothing untouched, save perhaps for the foundation slab. Works on the infrastructure, which greatly improve the facility's energy credentials, have been completed and already give the East Hall a modern look and feel. The primary focus of the LS2 works, the maintenance and upgrading of the beam lines linking the Proton Synchrotron's proton beams to the many experiments of the facility, is also nearing completion.

(Continued on page 2)

A WORD FROM THE DIRECTOR GENERAL

INTRODUCING THE NEW MEMBERS OF CERN'S MANAGEMENT

As the new year begins, I would like to take the opportunity to introduce the newcomers to the Directorate and Enlarged Directorate. The latter brings together the directors, the department heads and the head of the Occupational Health & Safety and Environmental Protection unit (HSE).

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A WORD FROM THE DIRECTOR GENERAL

INTRODUCING THE NEW MEMBERS OF CERN'S MANAGEMENT

This year, we welcome three new Directors: Raphaël Bello, Mike Lamont and Joachim Mnich. Raphaël Bello, Director for Finance and Human Resources, is a graduate of the prestigious French *École nationale d'administration* (ENA). He comes from the French civil service, where he held a range of key posts in the Ministry for the Economy and Finance and the Ministry of Foreign Affairs, experience that will be invaluable to CERN as we start to prepare for future projects. Mike Lamont, Director for Accelerators and Technology, is a familiar face at CERN, having joined in 1989 to work on the SPS and LEP, before moving to the LHC in 2001. With his long experience in accelerator operation and projects, he is well placed to lead the sector for the coming five years. Joachim Mnich, Director for Research and Computing, will also be familiar to many. Coming from the DESY Directorate, Joachim has a strong links with CERN going back to his involvement with the L3 experiment from 1987-1999, and more recently with CMS. The research and technical sectors will be reinforced by the introduction of deputies for Joachim and Mike. Malika Meddahi becomes Deputy Director for Accelerators and Technology, while Pippa Wells becomes Deputy to Joachim Mnich. Both joined CERN in the 1980s, and between them they have significant experience covering several experimental and accelerator projects.

There are also changes to departmental and HSE management, and I am very pleased to welcome Mar Capeans, Katy Foraz, Brennan Goddard, Rhodri Jones and Benoît Delille to the Enlarged Directorate. Mar Capeans heads the Site and Civil Engineering department. Her strong background in particle physics and technology makes her an ideal interface between the development of the CERN sites and the research community. Katy Foraz's long experience in intervention coordination and planning in the accelerator sector will be very useful to her in her role as head of the Engineering department. Brennan Goddard's career has seen him develop wide competencies in accelerator systems, most recently with the LHC Injectors Upgrade project, the High-Luminosity LHC and the FCC study, placing him well for his new role as head of the Accelerator Systems Department, while Rhodri Jones's deep knowledge of beam instrumentation and diagnostics will be in valuable as he takes up the position of head of the Beams Department. Last but not least, Benoît Delille, the new head of the HSE unit, brings his long experience in safety engineering and project management to the job.

The remaining department heads, along with Charlotte Warakaulle as Director for International Relations, are unchanged. I am sure that I speak for all of us, newcomers and old-hands alike, in saying that we feel privileged to be working with you at this remarkable Laboratory in these unprecedented times. There are huge challenges ahead of us, but exciting opportunities as well, both for CERN and for your own individual professional development. We are all looking forward to sharing the rich road ahead with every one of you.

Fabiola Gianotti
Director-General

LS2 REPORT: GETTING READY FOR THE FUTURE OF PHYSICS IN THE EAST AREA

All of the 61 power converters, as well as almost all services – including cables, cooling and floors – stand ready to support the four beam lines whose magnets, a mixture of refurbished and brand-new dipoles and quadrupoles, are currently being installed. This painstaking task should be completed by April 2021, in time for the start of operation in the autumn. The new laminated yoke magnets will run cyclically only when the machine is operating, as opposed to the previous magnets, whose continuous energy consumption was a source of energy waste. Together with the new SIRIUS power converters, they will greatly contribute to reducing energy consumption in the facility.

The new beam lines will be game changers for research in the East Area, which focuses on irradiation of materials, test beams and atmospheric science. The experiments, namely IRRAD, CHARM and CLOUD, as well as users among the LHC experiments and others, will now make the most of the particle beams whose energy range has been broadened to span a region of 0.3 to 15 GeV/c. These performances perfectly complement the energy range available in the North Area, ranging from 15 to 400 GeV/c. In addition, the secondary beam lines (transferring beams of particles like muons or electrons) will, for the first time, be able to deliver pure beams of these secondary particles, for more accurate and qualitative data-taking. These improvements, coupled with better instrumentation relying on scintillating fibre technology, have already attracted a number of potential new users, including neutrino research collaborations, in line with the recommendations of the European Strategy on Particle Physics.

Sébastien Evrard, from the Engineering department, led the renovation project. He believes that the works in the East Hall mark the beginning of a new era in experimental areas at CERN: “These facilities are finishing their first life and must embark on their second one. In that regard, the East Area could serve as a model for future upgrades in places like the North Area. These big investments yield abundant results.” Sébastien's colleague Johannes Bernhard (beam line physicist and leader of the Liaison to Experiments section in the BE-EA group) can look forward to reaping the fruits of these investments after the start of data collection by the constellation of experiments that have also been working hard to upgrade their equipment.

And beyond the collaborations, other prized guests eagerly await the East Hall 2.0, as Johannes points out: “The winners of the Beamlines for Schools competition for high-school students always conducted their experiment proposals on one of our beam lines before LS2. It's always a pleasure to welcome them at CERN and we are all really looking forward to making it happen again soon!”

Dipole magnets of the MCB type - these magnets are currently being installed on the beam lines (Image: CERN)

Thomas Hortala

BASE OPENS UP NEW POSSIBILITIES IN THE SEARCH FOR COLD DARK MATTER

The Baryon Antibaryon Symmetry Experiment (BASE) at CERN's Antimatter Factory has set new limits on how easily axion-like particles could turn into photons

Jack Devlin, physicist, adjusts the sensitivity of the antiproton beam monitor of the BASE experiment. (Image: CERN)

The Baryon Antibaryon Symmetry Experiment (BASE) at CERN's Antimatter Factory has set new limits on the existence of axion-like particles, and how easily those in a narrow mass range around 2.97 neV could turn into photons, the particles of light. BASE's new result, published by *Physical Review Letters*, describes this pioneering method and opens up new experimental possibilities in the search for cold dark matter.

Axions, or axion-like particles, are candidates for cold dark matter. From astrophysical observations, we believe that around 27% of the matter-energy content of the universe is made up of dark matter. These unknown particles feel the force of gravity, but they barely respond to the other fundamental forces, if they experience them at all. The best accepted theory of fundamental forces and particles, called the Standard Model of particle physics, does not contain any particles that have the right properties to be cold dark matter. The result reported by BASE investigates this hypothetical dark-matter background present throughout the universe.

Since the Standard Model leaves many questions unanswered, physicists have proposed theories that go beyond it, some of which explain the nature of dark matter. Among such theories are those that suggest the existence of axions or axion-like particles. These theories need to be tested, and many experiments have been set up around the world to look for these particles, including at CERN. For the first time, BASE has turned the tools developed to detect single antiprotons, the antimatter equivalent of a proton, to the search for dark matter. This is especially significant as BASE was not designed for such studies.

“BASE has extremely sensitive detection systems to study the properties of single trapped antiprotons. These detectors can also be used to search for signals of particles other than those produced by antiprotons in traps. In this work, we used one of our detectors as an antenna to search for a new type of axion-like particles,” says Jack Devlin, a CERN research fellow working on the experiment.

Compared to the large detectors installed in the Large Hadron Collider, BASE is a small experiment. It is connected to CERN's Antiproton Decelerator, which supplies it with antiprotons. BASE captures and suspends these particles in a Penning trap, a device that combines electric and strong magnetic fields. To avoid collisions with ordinary matter, the trap is operated at 5 kelvins (around -268 degrees Celsius), a temperature at which exceedingly low pressures, similar to those in deep space, are reached. In this extremely well-isolated environment, clouds of trapped antiprotons can exist for years at a time. By carefully adjusting the electric fields, the physicists at BASE can isolate individual antiprotons and move them to a separate part of the experiment. In this region, very sensitive superconducting resonant detectors can pick up the tiny electrical currents generated by single antiprotons as they move around the trap.

In the work published by *Physical Review Letters*, the BASE team looked for unexpected electrical signals in their sensitive antiproton detectors. At the heart of each detector is a small, approximately 4 cm in diameter, donut-shaped coil of superconducting wire, which looks similar to the inductors you often find in ordinary electronics. However, the BASE detectors are superconducting and have almost no electrical resistance, and all the surrounding components are carefully chosen so that they do not cause electrical losses. This makes the BASE detectors extremely sensitive to small electric fields. The detectors are located in the Penning trap's strong magnetic field; axions from the dark-matter background would interact with this magnetic field and turn into photons, which can then be detected.

Physicists used the antiproton as a quantum sensor to calibrate the background noise on their detector. They then began to search for narrow frequency signatures inconsistent with detector noise, however faint, which could hint at those induced by axion-like particles and their possible interactions with photons. Nothing was found at the frequencies that were recorded, which means that BASE succeeded in setting new upper limits for the possible interactions between photons and axion-like particle with certain masses.

With this study, BASE opens up possibilities for other Penning trap experiments to participate in the search for dark matter. Since BASE was not built to look for these signals, several changes could be made to increase the sensitivity and bandwidth of the experiment and improve the probability of finding an axion-like particle in the future.

“With this new technique, we've combined two previously unrelated branches of experimental physics: axion physics and high-precision Penning trap physics. Our laboratory experiment is complementary to astrophysics experiments and especially sensitive in the low axion-mass range. With a purpose-built instrument we would be able to broaden the landscape of axion searches using Penning trap techniques,” says BASE spokesperson Stefan Ulmer.

FOR MORE INFORMATION

Photos and illustrations

- The BASE Penning trap electrodes and support structure: cds.cern.ch/record/2748764
- The Penning trap system used by the BASE experiment: cds.cern.ch/record/2042203
- Diagram and illustrations of parts of the BASE experiment: cds.cern.ch/record/2748762
- Stefan Ulmer, spokesperson, BASE: cds.cern.ch/record/2289432
- Photos of BASE experiment: cds.cern.ch/record/2748765

Video

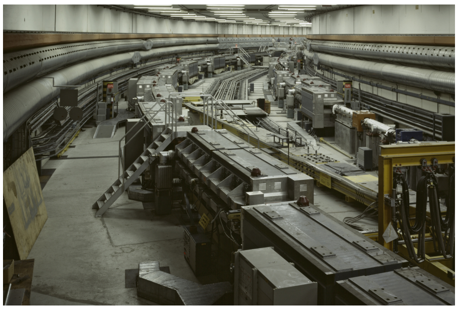
- Video News Release: videos.cern.ch/record/2749933
- Interview with BASE spokesperson, Stefan Ulmer: videos.cern.ch/record/2750047

Other Axion search experiments based at CERN

- CAST: home.cern/science/experiments/cast
- NA64: na64.web.cern.ch/
- MADMAX: madmax.mpp.mpg.de/
- IAXO: iaxo.web.cern.ch/content/home-international-axion-observatory
- RADES: cds.cern.ch/record/2307579

LOOKING BACK ON 50 YEARS OF HADRON COLLIDERS

This week marks the 50th anniversary of collisions in CERN's Intersecting Storage Rings, the first hadron collider ever built



A section of the Intersecting Storage Rings, the world's first hadron collider. (Image: CERN)

On 27 January 1971, the first proton collisions inside the Intersecting Storage Rings at CERN heralded the beginning of a new era of experimental physics, one shaped by the ever-increasing energy reached by these discovery machines. On the occasion of this special anniversary, former LHC project director Lyn Evans and former ATLAS spokesperson Peter Jenni recount the history of hadron colliders in a CERN Courier feature article, from their conceptualisation by Norwegian engineer Rolf Widerøe in 1943 through to the quest for high luminosity and new energy frontiers opened up by the High-Luminosity LHC and future colliders.

From the Intersecting Storage Rings to the SPS proton–antiproton collider, the Tevatron (Fermilab) and finally the Large Hadron Collider, the road to higher energy hadron colliders was an arduous one, requiring the invention of countless concepts and technologies, not to mention sharp political skills. But the payoff was spectacular. The unprecedented energy available in hadron collisions and the versatility of the detectors complementing the machines led to many of the most famous particle-physics breakthroughs, including the discoveries of the W and Z bosons at the Super Proton Synchrotron, the top quark at the Tevatron and, of course, the Higgs boson at the LHC.

While the LHC has at least 15 years of operation ahead of it, a technical and financial feasibility study is under way to assess CERN's next step into the unknown: a 100 km circular hadron collider with an energy of at least 100 TeV, as recommended by the recent update of the European Strategy for Particle Physics. If built, the success of such a machine will rest on the lessons learned from previous generations of hadron colliders and their fantastic detectors.

Read more in the CERN Courier. (*https://cerncourier.com/a/discovery-machines/*)

Thomas Hortala

CERN AND ATTRACT FEATURED AT FALLING WALLS 2020

The Falling Walls 2020 conference hosted a debate entitled "Does CERN need another supercollider?" and gave a prize to the ATTRACT project

The Falling Walls conference featured CERN during its online 2020 event, hosting a debate entitled "Does CERN need another supercollider?" and giving a prize to the European-funded ATTRACT project.

Falling Walls, an organisation based in Berlin, is known for its highly produced and well-attended annual conference, which covers "the next walls to fall in science and society".

During the 2020 conference, which was held online, journalist Zulfikar Abbany discussed with panellists Ursula Bassler (CERN), Nigel Lockyer (Fermilab), Jeremy Farrar (Wellcome Trust) and Beate Heinemann (DESY) the need for a supercollider for particle physics, questioning if other avenues to new knowledge could be installed.

In response to the question "Is CERN being greedy?", Bassler said: "If we want to make progress in particle physics, we will need higher energy and therefore a bigger machine." Farrar complemented the statement by saying that "CERN is a truly international collaboration that welcomes people from all over the world. As an open, transparent and welcoming centre, it sets a standard in science. We, in the health sector, have a lot to learn from how CERN collaborates."

In addition to featuring a CERN-focused debate, Falling Walls bestowed a prize on the ATTRACT project. "The ATTRACT project proposes a change in mindset on how new technologies can be funded. It aims to streamline the pathway of innovation from fundamental research to society", said Pablo Garcia Tello, coordinator for European-funded projects at CERN, in the video submitted for the prize.

During Phase I, ATTRACT was granted € 17 million to fund 170 breakthrough projects for 12 months, enabling them to implement and develop their research idea before presenting their work at the Final ATTRACT Conference in September 2020. ATTRACT has just received its second-round grant from the European Commission, as a continuation of ATTRACT Phase I. The grant consolidates the recognition of European research infrastructures as innovation drivers. **The online kick-off meeting for this second phase will take place on 1 February from 9 a.m. CET and is open to the public.**

Claudia Marcelloni de Oliveira

THE RISE OF THE RADIATION PROTECTION ROBOTS

Meet Mario Di Castro, leader of the Mechatronics, Robotics and Operations section, in the last of our Knowledge Transfer spotlight series

Mario Di Castro has developed a range of equipment capable of carrying out work in hazardous environments (Image: CERN)

Intelligent robotics systems are becoming essential for carrying out work in harsh environments, both at CERN and in industry. That is why Mario Di Castro's work on intelligent robots capable of conducting various activities in contaminated areas caught the interest of CERN's Knowledge Transfer (KT) group, which scouts for unique knowledge and cutting-edge technologies throughout the Organization to maximise its global positive impact on society.

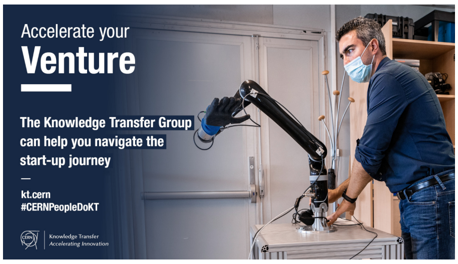
Mario has played an important role in building up the team behind CERN's mechatronics activities, which develops robotic solutions for remote inspection and maintenance that rely on software used to manage autonomous and intelligent robotic platforms. The technology includes drivers that allow integration of various commercially available components, such as sensors and robotic arms, into the hardware platforms. Part of this software was first licensed to the start-up Ross Robotics, a company that develops modular robotics platforms. Mario has also participated in the support of other start-up activities through the collaboration agreement with Terabee, a sensor company that was hosted in the French Business Incubation Centre of CERN Technologies, InnoGEX.

Mario gladly acknowledges that CERN's challenging environment has catalysed the Organization's progress in the field of robotics: "We resort to remote maintenance to face the environmental hazards that characterise CERN, and we are always striving for innovations in this field". The harsh environment, especially in regard to radiation levels, led to the development of nifty robotic gems available for technology transfer: CERNBot, a modular and flexible platform capable of high-precision operation in the presence of ionisation radiation, and the Train Inspection Monorail (TIM), a unique, modular, extensible robotic inspection monorail capable of carrying out a variety of different missions autonomously.

More recently, Mario has been working with CERN's fire brigade on MARCHESE, an inexpensive, lightweight and portable device that will recognise human beings and monitor health parameters from a distance through the use of machine learning. After participating in a workshop with HUG exploring how ICT technologies developed at CERN could contribute to addressing technological challenges in the healthcare sector, he began to explore new potential applications. With the support of KT and its medical applications budget, Mario has received funding and resources for further research and development.

Mario's numerous knowledge transfer activities throughout his career have given visibility to his activities externally and led to innovation in his work at CERN: "I always gain different insights on my research when talking to industry. This translates into interesting evolutions in the technologies that I develop".

Learn more about how to get involved in CERN's knowledge transfer activities here (*https://kt.cern/who-are-you/cern-personnel-collaborating-knowledge-transfer-group*) **.**



Linn Tvede

XCITEMENT DOWN UNDER: AUSTRALIA GETS FIRST X-BAND FACILITY

Half of a CERN high-gradient test facility embarks on a new life at the University of Melbourne

MelBOX arrives at the University of Melbourne (Image: Matteo Volpi/University of Melbourne)

On 16 September 2020, a container filled with pallets, boxes and electronic racks left CERN's Meyrin site to embark on a two-month sea journey to the other side of the world. On 17 November, at precisely 3.12 p.m. local time, its ship docked at Port Melbourne, from where, following customs clearance earlier this year, the container and its contents were transported to a new home: the University of Melbourne.

The container held the components of the southern hemisphere's first X-band radio-frequency test facility; "X-band" refers to the ultra-high-frequency at which the device operates. The device, half of the CERN facility known as XBOX-3, will soon be a part of the "X-Lab" at the University of Melbourne. Its journey resulted from an agreement signed between CERN and the Australian Collaboration for Accelerator Science in 2010.

XBOX-3 and its two predecessors were built at CERN in the context of the Compact Linear Collider (CLIC) study that envisions building a linear electron–positron collider with a collision energy of 380 GeV. They were built to develop the technology to accelerate particles to a high velocity over a relatively small distance. Such accelerators are described as possessing a high acceleration gradient. In addition to aiding the development of the next generation of particle accelerators, the technology of high-gradient acceleration is also useful for medical applications, such as radiotherapy, and in synchrotron light sources.

In 2015, CERN decided that half of XBOX-3 would eventually be sent to Australia to help its nascent accelerator community. "Having the only X-band facility this side of the equator is a huge boost to the growing accelerator-physics community in Australia. It will allow us to train specialists, do novel research and create exciting industry-engagement opportunities based on the many applications of accelerators," says Suzie Sheehy, group leader of the Accelerator Physics Group at the University of Melbourne. "The Melbourne X-Lab team, which includes senior researchers, PhD students and support staff, is grateful for CERN's contribution to our project."

The device will be renamed MelBOX, in light of its new home, and will come online in its new avatar this year.

See more photos on CDS (*https://cds.cern.ch/record/2749436*)

Achintya Rao

A NEW WAY TO LOOK FOR GRAVITATIONAL WAVES

A duo of researchers from CERN and DESY show how data from radio telescopes can be used to search for high-frequency gravitational waves

The EDGES radio telescope. (Image: Suzyj, CC BY-SA 4.0, via Wikimedia Commons)

In a paper published today in *Physical Review Letters*, Valerie Domcke of CERN and Camilo Garcia-Cely of DESY report on a new technique to search for gravitational waves – the ripples in the fabric of spacetime that were first detected by the LIGO and Virgo collaborations in 2015 and earned Rainer Weiss, Barry Barish and Kip Thorne the Nobel Prize in Physics in 2017.

Domcke and Garcia-Cely's technique is based on the conversion of gravitational waves of high frequency (ranging from megahertz to gigahertz) into radio waves. This conversion takes place in the presence of magnetic fields and distorts the relic radiation from the early universe known as cosmic microwave background, which permeates the universe.

The research duo shows that this distortion, deduced from cosmic microwave background data obtained with radio telescopes, can be used to search for high-frequency gravitational waves generated by cosmic sources such as sources from the dark ages or even further back in our cosmic history. The dark ages are the period between the time when hydrogen atoms formed and the moment when the first stars lit up the cosmos.

“The odds that these high-frequency gravitational waves convert into radio waves are tiny, but we counterbalance these odds by using an enormous detector, the cosmos,” explains Domcke. “The cosmic microwave background provides an upper bound on the amplitude of the high-frequency gravitational waves that convert into radio waves. These high-frequency waves are beyond the reach of the laser interferometers LIGO, Virgo and KAGRA.”

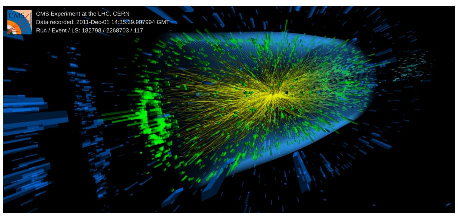
Domcke and Garcia-Cely derived two such upper bounds, using cosmic microwave background measurements from two radio telescopes: the balloon-borne ARCADE 2 instrument and the EDGES telescope located at the Murchison Radio-Astronomy Observatory in Western Australia. The researchers found that, for the weakest possible cosmic magnetic fields, determined from current astronomical data, the EDGES measurements result in a maximum amplitude of one part in 10^{12} for a gravitational wave with a frequency of around 78 MHz, whereas the ARCADE 2 measurements yield a maximum amplitude of one part in 10^{14} at a frequency of 3-30 GHz. For the strongest possible cosmic magnetic fields, these bounds are tighter – one part in 10^{21} (EDGES) and one part in 10^{24} (ARCADE 2) – and are about seven orders of magnitude more stringent than current bounds derived from existing laboratory-based experiments.

Domcke and Garcia-Cely say that data from next-generation radio telescopes such as the Square Kilometre Array, as well as improved data analysis, should tighten these bounds further and could perhaps even detect gravitational waves from the dark ages and earlier cosmic times.

Ana Lopes

CMS COLLABORATION RELEASES ITS FIRST OPEN DATA FROM HEAVY-ION COLLISIONS

CMS data recorded in 2010 and 2011 from lead–lead collisions at the Large Hadron Collider have been released into the public domain for the first time



A heavy-ion collision recorded by CMS in 2011 (Image: Tom McCauley/CMS/CERN)

For a few weeks each year of operation, instead of colliding protons, the Large Hadron Collider (LHC) collides nuclei of heavy elements (“heavy ions”). These heavy-ion collisions allow researchers to recreate in the laboratory conditions that existed in the very early universe, such as the soup-like state of free quarks and gluons known as the quark–gluon plasma. Now, for the first time, the Compact Muon Solenoid (CMS) collaboration at CERN is making its heavy-ion data publicly available via the CERN Open Data portal.

Over 200 terabytes (TB) of data were released in December, from collisions that occurred in 2010 and 2011, when the LHC collided bunches of lead nuclei. Using these data, CMS had observed several signatures of the quark–gluon plasma, including the imbalance between the momenta of each jet of particles produced in a pair, the suppression (“quenching”) of particle jets in jet–photon pairs and the “melting” of certain composite particles. In addition to lead–lead collision data (two data sets from 2010 and four from 2011), CMS has also provided eight sets of reference data from proton–proton collisions recorded at the same energy.

The open data are available in the same high-quality format used by the CMS scientists to publish their research papers. The data are accompanied by the software that is needed to analyse them and by analysis examples. Previous releases of CMS open data have been used not only in education but also to perform novel research. CMS is hopeful that communities of professional researchers and amateur enthusiasts as well as educators and students at all levels will put the heavy-ion data to similar use.

“Our aim with releasing CMS data into the public domain via the Creative Commons CC0 waiver is to preserve our data and the knowledge needed to use them, in order to facilitate the widest possible use of our data,” says Kati Lassila-Perini, who has led the CMS open-data project since its inception in 2012. “We hope that those outside CMS will find these data as fascinating and valuable as we do.”

CMS has committed to releasing 100% of the data recorded each year after an embargo period of ten years, with up to 50% of the data being made available in the interim. The embargo affords the researchers who built and operate the CMS detector adequate time to analyse the data they collect. With this release, all of the research data recorded by CMS during LHC operation in 2010 and 2011 is now in the public domain, available for anyone to study.

You can read more about the release on the CERN Open Data portal: opendata.cern.ch/docs/cms-releases-heavy-ion-data

Achintya Rao

CERN PROCUREMENT AND INDUSTRIAL SERVICES RECEIVE EIPM-PETER KRALJIC PRIZE FOR EXCELLENCE

The EIPM-Peter Kraljic Awards celebrate purchasing organisations that demonstrate high levels of creativity, innovation and respect for the environment and society

The CERN Procurement and Industrial Services group has been honoured with the prestigious EIPM-Peter Kraljic Prize for Excellence in the “Master of Business Continuity” category in the 2020 edition of the awards. This is the second time the group has received an EIPM-Peter Kraljic award.

Created in 2010, the EIPM-Peter Kraljic Awards celebrate purchasing organisations that deliver outstanding performance for their company and demonstrate excellence in creativity, innovation and respect for the environment and society.

“We are honoured and humbled to receive this award. 2020 has been an extraordinary year and it feels great to know that our efforts in pulling through the strenuous challenges of the year are being recognised as an example for others to follow,” declared Anders Unnervik, the head of CERN's Procurement and Industrial Services group.

Read the full article (https://procurement.web.cern.ch/news/2020-award-excellence-cern-procurement-and-industrial-services) on the Procurement and Industrial Services group website.

The 2020 EIPM-Peter Kraljic Prize for Excellence, awarded to the CERN Procurement and Industrial Services group last December. (Image: CERN)

Priyanka Dasgupta

COMPUTER SECURITY: ONE ADVANTAGE OF TELEWORKING

The number of notifications of alleged copyright violations we received in 2020 was much lower than in previous years

From the computer security perspective, teleworking adds to the portfolio of security risks, as the remote staff member works in an uncontrolled/uncontrollable, unmonitored and very often less secure environment. As the word “teleworking” implies, it combines “tele” and “working”. Some crafty minds interpret “tele” as the common abbreviation of “television”, ignoring the Latin roots. Thus, for them, “teleworking” means arranging their professional activities with watching TV in parallel. Or, today, watching Netflix(1). And that might not be far-fetched!

Like any other academic institution, university or company with a rather relaxed “bring your own device” policy, CERN is regularly subject to allegations of copyright violations. People on site bring in their home laptops that are still running file-sharing applications, which then try to disseminate, share and exchange movies, videos or music with peers. While it is a matter for discussion (and agreement) between you and your supervisor whether listening to music while working is OK [(2)] (or not), and while we assume in that case that you legally own that music, the sharing of music and other copyrighted material is forbidden by many national laws and by CERN's Computing Rules aka Operational Circular No. 5. CERN takes any kind of reported or detected copyright violation very seriously. Any allegation is usually followed up by the CERN Computer Security Team, and potentially – depending on the gravity of the allegation – by CERN's legal service and the HR department. If the infraction is confirmed, potential infraction costs are usually passed on to the person owning the device or to their home institute.

In this respect, at least, teleworking has a benefit for CERN. The number of notifications of alleged copyright violations we received in 2020 was much lower than in previous years – thanks to fewer people on site, thanks to fewer devices on the CERN network, and thanks to teleworking (and thus a shift of such allegations away from CERN). A small plus for computer security.

Still, watch out when working from home! The overall risk, even when reduced in this particular aspect, remains high! Make sure that your home computer used for teleworking is properly secured, always kept up to date and running decent antivirus software. Watch out for suspicious e-mails, attachments or links: STOP – THINK – DON'T CLICK! One malicious webpage is enough to put your digital life and CERN's computer security at risk. As your computer is most likely also used for personal matters, watching out also applies to your leisure time. Train your family members if they use the same computer for fun (like your kids playing online games – they might just make a "wrong" click). Ideally, use different computers for work and pleasure. In any case, be vigilant and alert. The evil side is trying to take advantage of these exceptional times. We prefer you and your computer to stay safe and sound!

(1) Please don't. It is a privilege to work remotely – not all of us are lucky enough to have a profession that allows for teleworking. This privilege is built on trust: the trust put in you by the Organization, the trust that you will perform as well as you would when on the CERN site.

(2) We are keenly interested in any valid use case for watching videos while working.

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.

The Computer Security Team

Announcements

NEW PARTICLE DATA GROUP REVIEWS & BOOKLETS

The 2020 PDG Reviews & Booklets from the Particle Data Group are now available

PDG Reviews & Booklets are available to pick up in front of the Library (building 52/1-052).

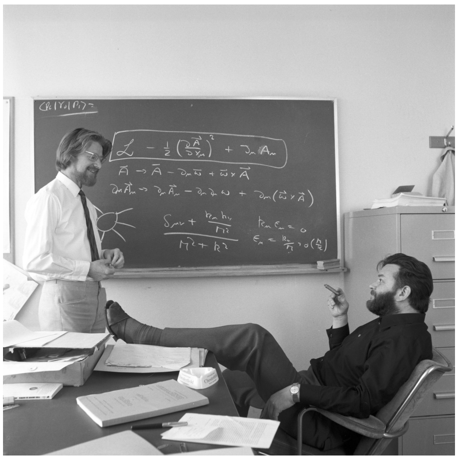
They can also be ordered online for delivery to your home address on the following website: https://pdg.lbl.gov/

If you have any questions or would like to order multiple copies, please contact: library.desk@cern.ch

CERN Library

Obituaries

MARTINUS JUSTINUS GODEFRIEDUS VELTMAN (1931 – 2021)



Martinus J. G. Veltman (right) with John S. Bell at CERN in 1973. (Image: CERN)

Martinus ("Tini") Veltman started his scientific career relatively late: he obtained his PhD from the University of Utrecht in 1963[(1)]under the supervision of Leon Van Hove, but had already moved to CERN in 1961, where Van Hove, had been named Leader of the CERN Theory Division. At CERN, Van Hove studied mainly hadronic physics but Veltman became interested in weak interactions[(2)]and current algebras. It is in these fields that he made his most important and lasting contributions.

In around 1966, he was trying to understand the deeper origin of the conservation, or near conservation, of the weak currents. In particular, he tried to throw some light on the general confusion that prevailed at the time concerning the so-called "Schwinger terms" in the commutators of two current components. While on a visit from CERN to Brookhaven, he wrote a paper in which he suggested a set of divergence equations which generalised the notion of the covariant derivative of quantum electrodynamics. This fundamental idea was taken up the following year and developed further by John Stewart Bell. At that time, people had postulated the existence of a pair of charged, massive vector W_±bosons as intermediaries of the weak interactions so, motivated by these divergence equations, Veltman decided to study their field theory properties. The electrodynamics of such charged bosons had been formulated already by T.D. Lee and C.N. Yang in 1962. They had shown that electromagnetic gauge invariance allows expression of the vector boson's charge e, magnetic moment μ and quadrupole moment Q in terms of only two parameters, e and κ, as $\mu = e(1+\kappa)/2m_W$ and $Q = -e\kappa/m_{W^2}$. The resulting theory is highly divergent but Veltman noticed that many divergences cancel for the value $\kappa = 1$. This is the value predicted by a theory in which $W^{\pm}$ and the photon form a Yang-Mills triplet. For Veltman, this was a clear signal that the theory of weak and electromagnetic interactions must obey a Yang-Mills gauge invariance.

The study of a massive Yang-Mills field theory turned out to be very complicated, both conceptually, since the correct Feynman rules were not known and practically, because the number of terms grew very fast. Veltman had to develop a computer program to handle them. He called it "Schoonschip" ("Clean ship" in Dutch) and it was the first program of symbolic manpulations applied to theoretical high-energy physics. Schoonschip opened the way to the modern computer codes used to manipulate Feynman diagrams, which are responsible for the enormous progress made with the sophisticated calculations of the Standard Model processes that have been produced in the last decades.

The experience Veltman had acquired in his thesis, working with diagrams in which the particles in the intermediate lines were on their mass shells, the so-called "cutting rules", was precious. He spent 1968 at Orsay near Paris, where he lectured on Yang-Mills and path integrals and, in 1969, he was joined in Utrecht by Gerard 't Hooft, a graduate student with whom he shared the 1999 Nobel Prize. Their work was a real "tour de force". They invented and developed many techniques that became standards in particle physics. The citation of the Nobel Prize reads "...for elucidating the quantum structure of electroweak interactions in physics". The importance of this work cannot be overestimated. Although the citation refers to the electroweak interactions, their result made possible the subsequent discovery of QCD. Since that time, gauge theories have become the universal language of fundamental physics.

Veltman and 't Hooft gave the first detailed presentation of their results at a small meeting in Orsay in 1971. This meeting was remarkable in many respects. Firstly, it offered the first complete picture of the renormalisation properties of Yang-Mills theories. Secondly, it triggered stimulating discussions among the participants, in particular regarding the vital importance of the axial current anomaly cancellation.

With the rise of the Standard Model, a long series of meetings was launched, which became known as "triangular meetings" (Paris-Rome-Utrecht). Subsequently extended to other European centres, the triangular meetings played an important role in the development of new ideas in field theory and in establishing a European network in theoretical physics. Veltman was a central figure in those meetings.

After the discovery of the Intermediate Vector Bosons, several groups embarked on a systematic study of the higher order electroweak corrections to the predictions of the Standard Model. The group led by Veltman was among the most active. A particular focus of attention was the so-called $\rho = M_W/\cos\theta M_Z$ parameter. Veltman observed that its deviation from unity, the value predicted to lowest order in the Glashow-Weinberg-Salam theory, depends quadratically on the top quark mass and logarithmically on the Brout-Englert-Higgs boson mass. Precise determinations of the ρ parameter led eventually to a prediction of the top quark mass, confirmed by the top quark discovery of CDH at Fermilab. Even more precise values of M_W and Mtop led to significant limitations to the BEH boson mass, in agreement with the mass of the scalar particle discovered by ATLAS and CMS in 2012.

Veltman stayed in Utrecht until 1981. He attracted many talented young students and established a very active school of theoretical high-energy physics in the Netherlands. He was a lifelong supporter of CERN and an elected member of the CERN Scientific Policy Committee from 1976 to 1982. In recent years, we often saw him at the SPC annual meetings to which former members are invited, and enjoyed the acute and humorous remarks he used to include in his interventions.

John Iliopoulos and Luciano Maiani

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(1) His first publication is entitled "Unitarity and causality in a renormalizable field theory with unstable particles", Physica, Vol. 29, 186 (1963).

(2) He even joined Bernardini's neutrino experiment for a while.

Ombud's corner

OH NO, A NEW BOSS!

"Since Joanne took over from Serge* as our team leader, things haven't been going well. Serge knew our work inside out. We understood each other without having to spell everything out. It was only to be expected – he was our supervisor for 12 years. But we don't know what Joanne expects from us, or how she works. What should we do?"*

With the current reorganisation, some of us are bound to find ourselves with a new boss. This is a delicate situation that can elicit as much enthusiasm as concern. What can we do to make it as smooth a ride as possible?

This is an entirely legitimate question when you have a new boss. The status quo is disrupted and a period of watching and wondering ensues. During this phase, it is important for both the team members and the new boss to keep an open mind and be realistic. Take the time to observe and make up your mind about each other, without prejudice. Give each other the benefit of the doubt.

Joanne, despite being highly qualified for the role, is also uncertain about some things: *"I'm the newcomer in a team of competent, experienced colleagues who have known each other for years. I know what my superiors expect of me, but I don't know what my team expects. I need to learn what their strengths are, where they can improve, and what their potential is."*

The team members also have expectations of their own: *"I hope Joanne will make an effort to sit down with each of us and get to know us. I hope she'll listen to our views and aspirations. I hope she'll tell us soon what she plans to achieve, and consult us about how to go about it."*

Having a new boss is a win-win situation, provided that everyone shows willing and is open to dialogue. To begin with, there will probably be some uncertainty, misunderstandings and disappointment on both sides. But if everyone is open-minded and clear about what they expect, new horizons can open up.

The best approach is for everyone to start with a clean slate, whether you're the boss or a team member. Set aside your prejudices, forget about people's reputations, give each other a chance to prove yourselves, and maximise your chances of success. Once the observation phase is over, it's also very important that everyone is honest about what they expect and what they can realistically deliver. Those initial fears can turn into opportunities. After this adjustment phase, the team will run smoothly again, to the benefit of everyone.

**Names have been changed*

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.