CERN Bulletin

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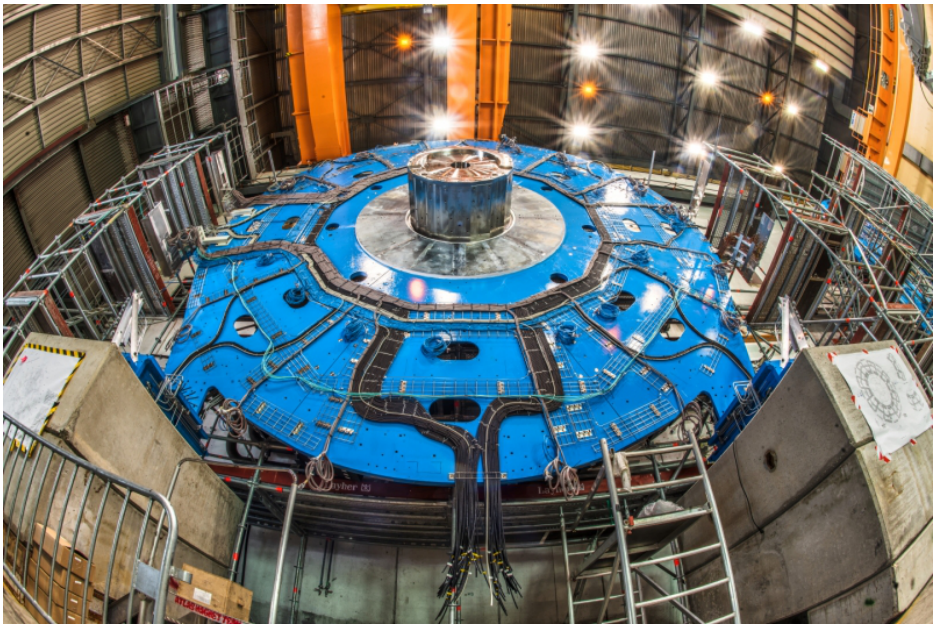
THE NEW SMALL WHEELS SET ATLAS ON TRACK FOR HIGH LUMINOSITY

An upgrade to the "Small Wheels", the innermost sections of the ATLAS muon end-cap system, will help ATLAS cope with the conditions at the HL-LHC



The mechanical structure of the New Small Wheel (Image: CERN)

To continue exploring the frontiers of particle physics following the discovery of the Higgs boson, the LHC experiments are preparing to enter a new era: a major upgrade to the LHC, known as the High-Luminosity LHC, is scheduled to come online in 2026. It will increase the luminosity of the collider, delivering more collisions and allowing the experiments to probe phenomena that are even rarer in nature.

At these higher collision rates, the detectors will see a larger number of particles flying through them than at present. Indeed, at the HL-LHC, the trigger rates for single muons in the ATLAS detector will go beyond what can be handled by the present equipment. Brand new components — from chambers for particle detection to complex support structures, services and new electronics — will prepare the detector to meet the demands of research at the high-luminosity frontier.

The ATLAS collaboration has taken a major step towards preparations for this phase with the completion of the two mechanical support discs for its New Small Wheel (NSW) upgrade, which were unveiled recently in Building 191 when the scaffolding used during their assembly was removed.

(Continued on page 2)

A WORD FROM MARTIN STEINACHER

MONEY TALKS... AND SOMETIMES TELLS A STORY

They say that money talks, and that's certainly true in a figurative sense, but sometimes it can have a genuinely interesting story to tell as well. That's the case with the ninth series of Swiss banknotes, from which the 200 franc note goes into circulation on 22 August 2018.

(Continued on page 2)

In this issue

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A WORD FROM MARTIN STEINACHER

MONEY TALKS... AND SOMETIMES TELLS A STORY

The new Swiss 200 franc note is particularly valuable not only because of its monetary value, but also because it is inspired by science, and in particular the science of matter: particle physics.

Each note in the ninth series of Swiss bank notes has been designed to tell a story about one aspect of the world, seen from a Swiss angle of course. The first of the new series that was released, the 50 franc note, tells a story of the wind, how it circulates around the globe, spreads the seeds of wild flowers, and allows the intrepid to enjoy the Swiss Alps from a vantage point beneath the canopy of a paraglider riding currents of mountain air. The 20 franc note is all about light, while the 10 tells a story about time. These were the first three notes released, and they will soon be joined by the 200 franc note, whose story is all about matter.

The Swiss National Bank keeps the identity of each note a closely guarded secret until the note is released, but the core design elements have been visible for all to see on the SNB website since the first note was issued on 6 April 2016. Each note features a hand, a globe, a location in Switzerland and an object. The location and the object for the 200 franc note are not hard to identify as representing CERN and the transformation of energy and matter in the LHC. It's an honour for CERN to have been chosen to represent one of the nation's most clearly identifiable assets, and I look forward to exploring the new note in all its intricacy. I hope you will too, but remember to spend it wisely!

Martin Steinacher
Director for Finance and Human Resources

THE NEW SMALL WHEELS SET ATLAS ON TRACK FOR HIGH LUMINOSITY

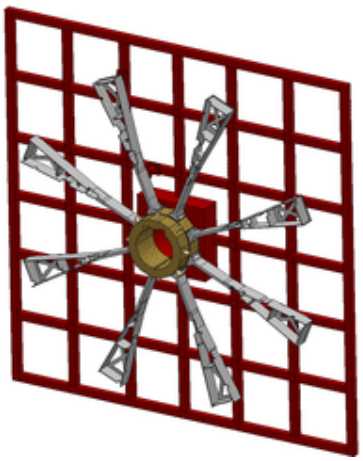
This upgrade project targets completion over the course of the second Long Shutdown of the LHC, in 2019 and 2020.

This was a milestone for the NSW project, which involves the replacement of the innermost sections of the ATLAS end-cap muon-detection system. The newly unveiled mechanical structures will support the full system, which will weigh over 100 tonnes. Not only will this mechanical structure support the particle detector chambers, it will also provide both radiation shielding and the flux return for the ATLAS solenoid.

Furthermore, new detector technologies will be installed, namely the Micromegas chambers and the Small Strip Thin Gap Chambers (STGC). These detectors are being built in institutes all over the world — in five different countries for each — and will be mounted on the wheels at CERN before being lowered into the ATLAS cavern. The two wheels, resembling a pie-shaped object, will then be placed on both side A and side C of the ATLAS detector. “One of the biggest achievements — and what surprises me again and again in this project — is how so many activities from different countries around the world have been brought together seamlessly at CERN,” says Stephanie Zimmermann, project leader for the NSW upgrade of ATLAS.

The New Small Wheels will allow much more stringent selection criteria for muons and provide new detector technology to handle the high backgrounds and high pile-up rates — the two main requirements for the High-Luminosity LHC.

29 February 2008: One of the current small wheels is lowered down the 100-metre shaft into the ATLAS cavern. The current small wheels will be replaced by the New Small Wheels as part of the Phase-I upgrade of ATLAS. (Image: CERN)

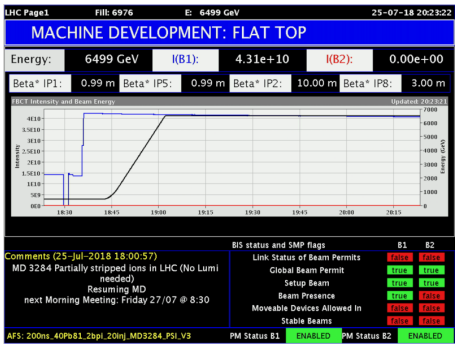


The support structure on which the final wedge-shaped chambers will be mounted. (GIF: Cristina Agrigoroae/CERN)

Cristina Agrigoroae

LHC REPORT: FIRST ACCELERATION OF PARTIALLY STRIPPED IONS

The LHC has just come out of a successful week of machine development (MD), used to carry out studies covering a wide spectrum of topics



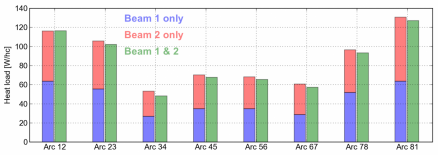
LHC Page 1 announcing the run with "partially stripped ions" in the LHC.

The LHC has just come out of a successful week of machine development (MD). At all of CERN's machines, MD periods are used to carry out studies covering a wide spectrum of topics. The studies that were carried out at the LHC concerned current issues, as well as tests of future configurations for LHC Run 3 (2021–2023) and the High-Luminosity upgrade (HL-LHC). Looking further into the future, some tests were performed in view of the Future Circular Collider for hadrons (FCC-hh) and of the Physics Beyond Colliders studies.

The heat load generated by the beams and deposited on the surface of the vacuum chamber, thought to be due to clouds of electrons generated by the closely spaced bunches inside the LHC, is one of the performance limitations of the LHC. The heat must be extracted by the cryogenic system, which has a limited capacity. Some of the LHC arcs (also called sectors) generate more than twice as much heat as the best arcs, a mystery that has not yet been understood. During this MD period, the heat load was measured carefully as a function of the beam intensity in order to compare it with models. It was also measured with single beams present in the LHC to disentangle the contributions of the two vacuum chambers to the heat load.

Looking further into the future, the Achromatic Telescopic Squeezing (ATS) optics currently in use were tested in new configurations that might provide baselines for operation during LHC Run 3. One option boosts the efficiency of the LHC octupole magnets, which play a crucial role in stabilising high-intensity beams. With the number of protons per bunch expected to increase by around 50% in Run 3, from around 120 billion per bunch to 170 billion per bunch, the tested configuration could become an important ingredient in controlling the intense Run 3 beams provided by the LHC injectors.

Within the framework of the Physics Beyond Colliders study, another test saw lead ions with one remaining electron attached to each nucleus successfully accelerated up to an energy of 6.5 TeV. Usually lead ions accelerated in the LHC are stripped of all their electrons (the last electrons are stripped off in a foil installed between the PS and the SPS); in this case, the foil thickness was tuned to retain one last electron. These "partially stripped ions" (PSI) must first be injected and accelerated in the SPS before they can be captured in the LHC. Because the remaining electron is easily stripped off by interaction with gas molecules, the lifetime of such beams depends critically on the vacuum conditions. Thanks to the excellent vacuum condition in the LHC, an ample lifetime of 40 hours was measured during the test. If the PSI are made to interact with a laser beam of the appropriate energy, the electron can absorb a photon and later re-emit it. In this process, the emitted photon energy is boosted by the large momentum of the ions in the LHC, yielding a beam of high-energy gamma rays. This is the concept of a gamma factory, which passed its first hurdle during this MD week.



This plot shows the heat load in each of the eight arcs of the LHC (in watts per 100 metres of the LHC ring). The heat load is measured in the presence of just one of the two beams, or with both beams in the accelerator. Both beams contribute equally to the heat generation. There are four good arcs (in sectors 34, 45, 56 and 67) with a low heat load, while the remaining arcs reach heat loads of up to two times higher. (Image: Giovanni Ladarola/CERN)

Matteo Solfaroli, Rogelio Tomas and Jörg Wenninger

ATTRACT: WHY AND HOW TO SUBMIT A PROPOSAL TO THE OPEN CALL

ATTRACT's objective is to create a sustainable innovation ecosystem for the breakthrough technologies in detection and imaging

ATTRACT's objective is to create a sustainable innovation ecosystem for the breakthrough technologies in detection and imaging that are needed for fundamental research, as well as to create societal impact through those technologies.

How? As a first step, by providing 100 kEUR seed funding to 170 selected projects that demonstrate the potential of breakthrough technologies in detection and imaging. This initial 17 MEUR fund is solely targeting High-Risk High-Gain concepts that address this cross-cutting field of research and applications.

The ATTRACT Consortium is composed of CERN, ESO, ESRF, EMBL, European XFEL, ILL, Aalto University, ESADE Business School and EIRMA. The project is financed by the EC under the H2020 programme.

CERN can benefit greatly from ATTRACT as it offers an opportunity for the Laboratory's diverse scientific and technical communities to find the necessary resources to develop disruptive new ideas in detection and imaging.

To select these 170 promising ideas, a three-month Open Call was launched on 1 August for organisations to submit proposals. All relevant information about the Call can be found here (*https://attract-eu.com/*).

CERN colleagues need to submit an EDH form (*https://edh.cern.ch/Document/General/EUProjectApproval/*) before the deadline of 17 September as part of the standard CERN procedure that must be followed before submitting proposals for EU projects.

A public information session (*https://indico.cern.ch/event/728232/*) about ATTRACT took place on 23 May.

The link above also includes a list of the members of the ad hoc CERN Working Group reviewing the proposals where CERN is involved as a potential partner or coordinator. Approaching the members of this group first might be a good initial step if you are intending to apply.

Romain Muller

CERN IS GUEST OF HONOUR AT SWISS NATIONAL DAY IN GENEVA

On 1 August 2018, CERN was the City of Geneva's guest of honour at the Swiss National Day celebrations at Parc La Grange

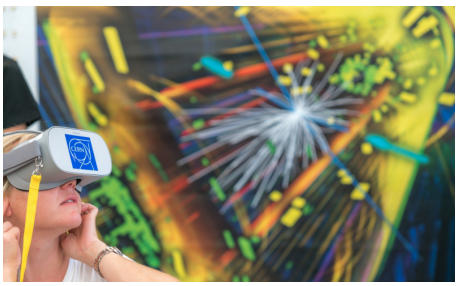


Image: Noemi Caraban Gonzalez/CERN

On 1 August 2018, CERN was the City of Geneva's guest of honour at the Swiss National Day celebrations at Parc La Grange.

CERN's tent, which offered workshops, virtual reality tours, physics demonstrations, educational games and the new “Particle Identities” quiz, was never empty from 1 p.m. to 8.30 p.m., giving many thousands of visitors the opportunity to learn about CERN's activities.

From the youngest to the oldest, experts to novices, a hugely diverse audience enjoyed these events. The CERN tent, offering workshops, virtual reality tours, physics demonstrations, educational games and the new “Particle Identities” quiz, was never empty from 1 p.m. to 8.30 p.m. Many thousands of visitors had the opportunity to learn about CERN's activities. The events were enjoyed by young and old, experts and novices – in short, a hugely diverse audience.

The theme of Mayor Sami Kanaan's mandate, “Challenges in digitalisation”, was the inspiration for many of the events organised by CERN, which, as the birthplace of the World Wide Web, has long been a key voice on that theme. Genevans learned how to program computers and robots at two continuous workshops. They also visited the CERN Data Centre, a living monument to the digital age, using virtual reality headsets.

Nearly forty CERN volunteers represented their laboratory with panache, perfectly adapting their explanations of their daily activities to the general public. From analysis of particle collisions through a “Connect the dots” activity to “fun with physics” demonstrations featuring the properties of magnets and vacuum bells, and ATLAS experiment colouring for the little ones, the events were a dazzling blend of entertainment and science outreach!

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Photos available at the following addresses:

- *http://cds.cern.ch/record/2633112*
- *https://cds.cern.ch/record/2633135*

Marie Beatrice Bouvier

HIGHLIGHTS FROM THE TABLE FOOTBALL TOURNAMENT

From 11 to 13 July, CERN was swarming with table football enthusiasts, who had signed up for the first charitable tournament

From 11 to 13 July, CERN was swarming with table football enthusiasts, who had signed up for the first charitable tournament organised by the CERN Table Football Club (CTFC) and the CERN & Society Foundation.

Twenty-eight teams competed vigorously through several qualification matches, with the Italian 'Afterlunch FC' winning the tournament on 12 July. A constant stream of people, including many who came along to cheer for their friends, crowded around the three tables set up for the tournament.

The CTFC was founded by a group of young table football enthusiasts in 2017 and welcomes all who enjoy this game. For them, this is a way of bringing people together in a fun and easy-going environment, following CERN's paradigm of uniting people from all around the world in the name of scientific collaboration and advancement.

Participants in this tournament not only had fun but also played for a good cause. All proceeds went to the CERN & Society Foundation in support of its education and outreach projects, and will help younger generations of scientists and engineers reach their potential.

Many thanks to the CTFC for collaborating with us! A big thank you also to all those who took part in this tournament and helped nurture the scientists of tomorrow!

Official communications

POSTER DISPLAYING GUIDELINES

Posters are an inherent part of CERN's landscape, facilitating the sharing of information around the Laboratory. New guidelines for displaying posters at CERN are available here (*https://admin-eguide.web.cern.ch/procedure/lignes-directric es-relatives-aux-affiches*). Please consult them before putting up your posters.

ADMINISTRATIVE CIRCULAR NO. 11 (REV. 6) - CATEGORIES OF MEMBERS OF THE PERSONNEL

Administrative Circular No. 11 (Rev. 6) entitled "*Categories of members of the personnel*", approved by the Director-General after discussion at the Standing Concertation Committee on 27 June 2018, is available via the following link: https://cds.cern.ch/record/2632961

The circular has been revised to address the situation of CERN students who find themselves subject to compulsory health insurance in Switzerland (i.e., students who are obliged to be simultaneously affiliated to both CHIS and LAMal). Under this new circular, as from 1 September 2018, those students will be exempt from the requirement to be insured with CHIS.

This circular cancels and replaces Administrative Circular No. 11 (Rev. 5) also entitled "*Categories of members of the personnel*" dated September 2017. It will enter into force on 1 September 2018.

HR department

EXTERNAL ACTIVITIES GUIDELINES POLICY

Following the entry into force of the "Integrity at CERN" document, in which the Organization's conflict of interest policy is elaborated, a working group convened by the Director-General has established a set of guidelines to clarify the framework applicable to employed members of the personnel (MPEs) who wish to engage in a professional, commercial or political activity outside the Organization.

The External Activities Guidelines take into account the many types of external activities pursued by MPEs, paying particular attention to the academic and scientific activities that contribute to the Organization's outreach. The Guidelines, as well as the external activities request form under Annex II, aim to raise awareness of the applicable rules, regulations and procedures, simplify the authorisation procedure and ensure that such requests are treated in a consistent and transparent manner.

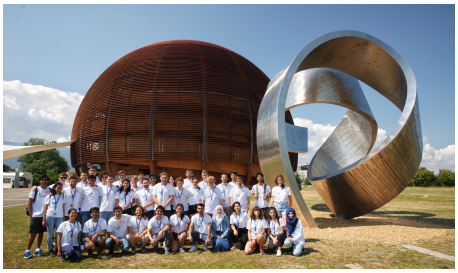
The External Activities Guidelines, approved by the Director-General following the recommendation of the Standing *Concertation* Committee after its meeting on 25 April 2018, are available via the following links:

- https://cds.cern.ch/record/2319295/files/External_Activities_-Guidelines.pdf
- https://admin-eguide.web.cern.ch/en/procedure/authorisation-engage-external-activities

HR department
HR-Head.office@cern.ch

Announcements

LIGHTNING TALKS BY CERN OPENLAB STUDENTS ON 16 AUGUST



The CERN openlab summer students, here in front of the Globe of Science and Innovation, have spent their summer gaining hands-on experience with cutting-edge technology. (Image: Andrew Purcell/CERN)

Want to learn about the exciting projects the CERN openlab summer students have been working on? Then come along to the "lighting talk" sessions on Thursday, 16 August. The students will each give five-minute presentations on their projects, explaining the technical challenges they have faced and describing their results so far. Topics covered in the students' projects this summer include machine learning, distributed computing, data analytics, and "the internet of things".

This year, the CERN openlab summer student programme is hosting 41 students — representing 22 different nationalities — for nine weeks. Undergraduate and Masters students in computer science, mathematics, engineering and physics have come from all over the world to spend a summer at CERN working on advanced computing projects with applications in high-energy physics.

As part of the CERN openlab Summer Student Programme, the students have also been invited to attend a series of lectures given by IT experts on advanced CERN-related topics and had the opportunity to visit the CERN facilities and experiments, as well as other organisations.

The lightning talks will take place in the IT Amphitheatre (31/3-004) from 1.30 p.m. to 4.30 p.m. on Thursday, 16 August. Following the second session, there will be an opportunity to discuss the students' work with them over drinks and snacks. For more information, please visit the Indico pages for the two sessions: 14/08/2018 (https://indico.cern.ch/event/727274/) and 16/08/2018 (https://indico.cern.ch/event/727275/).

Andrew Purcell

ROADWORKS AT GATE E FROM 3 AUGUST TO 30 OCTOBER

In order to improve traffic conditions, SMB, BE-ICS and HSE-RP will be undertaking work to reorganise the layout of Gate E from 3 August to 30 October.

The objectives of this work are:

- to improve the flow of traffic entering the Meyrin site from the D884;
- to install a vehicle number-plate reader system;
- to improve safety for personnel entering the site on foot or by bike.

During the work, the gate will remain open at the normal times (7.00 a.m. to 9.30 a.m. and 4.30 p.m. to 8.00 p.m.).

We apologise for any inconvenience caused.

Thank you for your understanding.

SMB Department

Obituaries

BURTON RICHTER (1931-2018)

Burt Richter (right) with future CERN Director-General Chris Llewellyn-Smith in 1977 after the inauguration for the Super Proton Synchrotron (Image: CERN)

Burton Richter, a major figure in particle physics who shared the Nobel Prize for the co-discovery of the J/psi meson, passed away on 18 July.

As well as being renowned for this discovery and several pioneering projects at SLAC, he undertook an experiment at CERN's Intersecting Storage Rings (ISR) – the world's first hadron collider – and also made the case for the Large Electron Positron (LEP) collider, which was the centrepiece of CERN's scientific programme during the 1990s and the forerunner to the LHC.

Born in New York in 1931, Richter studied physics at the Massachusetts Institute of Technology (MIT). There, he was introduced to the electron–positron system by Martin Deutsch, who was conducting classical positronium experiments, and had access to a particle accelerator. He wrote his thesis on the quadratic Zeeman effect in hydrogen and completed his PhD in 1956 on the photoproduction of pi-mesons from hydrogen.

By 1970, Richter's talents in experimental particle physics and accelerator physics led to the Stanford Positron-Electron Asymmetric Ring (SPEAR) at the Stanford Linear Accelerator Center (SLAC). Famously, in November 1974, the machine flushed out what the SLAC team dubbed the "psi" meson – a bound state of two charm quarks. Simultaneously, at Brookhaven National Laboratory on the other side of the continent, Sam Ting and his group had spotted the same resonance, which they christened the "J". The pair shared the 1976 Nobel Prize for Physics, just two years later, for their pioneering discovery of the J/psi, which proved the existence of a fourth type of quark.

Before he received the award, in 1975 Richter began a sabbatical year at CERN during which he pursued an experiment on the ISR.

"During his CERN sabbatical, Burt was hosted by Pierre Darriulat and we worked on adding a muon spectrometer arm to the R702 experiment. In later years, when Burt came to CERN we often shared an office in the UA2 area; I have fond memories of that time." – Peter Jenni

He also worked out the general energy-scaling laws for high-energy electron–positron colliding-beam storage rings, looking specifically at the parameters of a collider in the 100-200 GeV centre-of-mass energy range, arguing that such a machine would be required to better understand the relationship between the weak and electromagnetic interactions: "That study turned into the first-order design of the 27-km circumference LEP project at CERN that was so brilliantly brought into being by the CERN staff in the 1980s," he wrote in his Nobel biography.

His influential paper "Very High Energy Electron–Positron Colliding Beams for the Study of the Weak Interactions" (*Nucl. Instrum. Methods* 136, 1 (1976) 47-60) was followed by two detailed studies: one concerning the physics, published in November 1976 as CERN Yellow Report 76-18, of which Burt was a co-author, and an accelerator study headed by Kjell Johnsen.

"Burt's paper and his personal advocacy of high-energy electron–positron collision triggered interest at CERN, and had a powerful impact on the development of the Laboratory, also paving the way for the LHC and the discovery of the Higgs boson." – John Ellis

In 1978, along with others at SLAC, Richter began to investigate the possibility of turning the 3.2-km linear accelerator at SLAC into a linear electron–positron collider. Construction of the SLAC Linear Collider

began in 1983, and the first physics experiments began in 1990.

Richter went on to become the director of SLAC from 1984 to 1999, initiating interregional collaborations with DESY in Germany and KEK in Japan. He was a proponent of bringing into existence a high-energy linear collider as a global collaboration, and he never stopped fighting for the interests of the field.

"I got to know Richter after we received the Nobel Prize together in December 1976. A unique physicist, he was good in accelerator physics, in instrumentation as well as particle physics." – Samuel Ting

Matthew Chalmers
Editor, CERN Courier

A tribute to Burt Richter will also appear in the October issue of the CERN Courier .