



## MESSAGE FROM THE PRESIDENT OF THE COUNCIL

The highly successful second run of CERN's Large Hadron Collider, the LHC, concluded at the end of 2018. The experiments, both at the LHC and at CERN's other accelerators, continue to produce many new physics results, which is a great accomplishment in view of the staggering amount of data collected. Remarkable successes were also reported in accelerator research, by the AWAKE experiment for example, and in the preparation of the next generation of neutrino experiments with ProtoDUNE. All CERN personnel are to be commended for their sustained high-quality work, which makes these achievements possible.

In 2018, the Council welcomed the National Audit Office of Finland as the new CERN External Auditors. The Council is grateful to have received their reports on the 2018 CERN financial statements and annual report, as well as those of the CERN Pension Fund, and appreciates the energy with which the Finnish team have taken up this important task.

Particle physics is nearing an important crossroads at which researchers need to determine the future directions of the field. Addressing a number of important fundamental questions about the existence and nature of dark matter and dark energy, and the nature and meaning of the flavour structure of the Standard Model, will require accelerators and experiments with a reach beyond that of the present generation. Several alternatives are being studied, such as linear and circular lepton colliders, circular proton colliders, muon colliders and high-intensity neutrino beams. To examine all these options, the process of updating the European Strategy for Particle Physics was launched in 2018 with the establishment of the European Strategy Group and the Physics Preparatory group. The process will determine the optimal strategy for addressing these important questions in a resource-optimised way. It will continue throughout 2019 with thorough discussions that will engage the whole community of particle physicists. The new strategy will be presented to the Council for adoption in May 2020.

CERN remains attractive to countries wishing to join the Organization's front-line research in the spirit of international collaboration. In 2018, the Republic of Serbia was admitted as a new Member State, with membership becoming effective upon ratification by the Serbian Parliament. The Republic of Croatia was admitted as a new Associate Member State, with membership becoming effective upon ratification by the Croatian Parliament.

The Republic of Lithuania joined CERN as an Associate Member State after completing its internal approval procedures in January 2018.

This was the last year in which I had the honour to serve as President of the Council, and I look back with much pleasure on my period in office. As Council President, I discovered another aspect of this unique scientific institute that performs mind-boggling research, namely the strong spirit of co-operation between the Council and the management, for which I thank both the Council members and the CERN management team. I would also like to thank the Council Secretariat, the Legal Service and the Translation and Minutes Service, all of whom contribute to facilitating the life of the Council President. Finally, it is my pleasure to hand over the reins with confidence to the Council's next President, Dr Ursula Bassler.

Sijbrand de Jong

A handwritten signature in black ink, consisting of a stylized 'S' followed by a long horizontal stroke.



## MESSAGE FROM THE DIRECTOR-GENERAL

The end of 2018 saw the LHC's second run conclude on a glorious note. The experiments recorded more data than our ambitious goals had predicted, thanks to an outstanding performance from the accelerator complex over the past four years. The detectors and computing took the resulting deluge of data in their stride, and beautiful physics was the result. The highlight of the year was the establishment of the Higgs boson's couplings to the top and bottom quarks. Many publications have been produced, and more will come as analysis continues during the two-year long shutdown that we've just begun.

The LHC was the star of the show in 2018, but CERN is much more than just its flagship facility. The year saw very significant progress across the full scientific programme. For example, the Advanced Wakefield Experiment, AWAKE, demonstrated for the first time electron acceleration from plasma wakefields induced by a proton beam, an encouraging result towards developing technology for compact high-energy colliders. At the CERN Neutrino Platform, the world's largest liquid-argon neutrino detector, the single-phase prototype for the DUNE experiment in the US, reconstructed beautiful tracks from test-beam particles.

Beyond the scientific programme, highlights of 2018 include the admission of Serbia as a Member State, and of Croatia and Lithuania as Associate Member States. Once Serbia's and Croatia's ratification processes are complete, the CERN family will comprise 23 Member States and eight Associate Member States. The Science Gateway project, a new facility for scientific education and outreach to be built next to the Globe, also made great progress in 2018. The project was approved by the Council, and most of the funding was secured through generous donations.

As we enter 2019, it will not be particles, but people, that circulate in CERN's accelerator tunnels. Throughout the long shutdown, the underground areas will be a hive of activity. The upgrade of the LHC injectors (the LIU project) will be completed, and much work will be done in preparation for the High-Luminosity LHC project, HL-LHC, which will succeed the LHC in 2026. The four major LHC experiments will also undergo significant upgrades during the long

shutdown. The work is ambitious and demanding. Hundreds of components will be replaced, and many companies will contribute their technological expertise. The full accelerator complex will restart in 2021 for a three-year period of operation.

The year 2018 also saw the start of the process to update the strategy for particle physics in Europe. Which facilities will allow us to make the most progress towards addressing unresolved questions in fundamental physics? What kind of experiments will we need for the future? What are the priorities of accelerator and detector R&D in the coming years? These are the kinds of questions that our scientific community will be reflecting on throughout 2019 as the update of the European Strategy for Particle Physics maps out future opportunities for the field. LHC results, as well as design studies for future machines and experiments, have already provided an impressive corpus of knowledge to guide the debate.

You can discover more about these and other achievements in the pages of this report. All of them have been made possible by the great competence and dedication of CERN's personnel, along with strong and sustained support from the Council. My thanks, and those of the entire CERN management, go to them all. I am also grateful to Professor Sijbrand de Jong, the outgoing President of the Council, for the extremely fruitful, enriching and pleasant collaboration we have enjoyed over the past three years.

Fabiola Gianotti