



ISSUE 29

12 Jul 2019

FCC Week 2019 accelerates progress towards post-LHC colliders

by Panagiotis Charitos

FCC FCC Week 2019

Academic and research institutes, industrial partners and funding agencies met in Brussels for the Future Circular Collider (FCC) study annual meeting.



CERN's Director-General, Fabiola Gianotti, welcomes participants to the FCC Week 2019 in Brussels, Belgium. The event also marks the final event of the EU-funded Horizon 2020 EuroCirCol project. (Image: Nicolas Lobet/CERN)

From 24 to 28 June 2019, academic and research institutes, industrial partners and funding agencies met in Brussels for the Future Circular Collider (FCC) study annual meeting. Through its proposed ambitious projects, the FCC Week 2019 bolstered the interest of the international research community in preparing for the post-LHC era.

More than 400 researchers and industrial partners from around the world met to discuss innovations in key enabling technologies (i.e. superconductivity, high-field magnets, superconducting radio-frequency systems, vacuum and cryogenics) and review the diverse experimental programme offered by the proposed future accelerator facility. By providing, in a first stage, highest luminosity electron-positron collisions and, in a second stage, highest energy hadron collisions, the FCC will push the exploration of the fundamental laws of nature to unprecedented limits.

CERN's Director General Dr. Fabiola Gianotti and Dr. Wolfgang Burtscher, the European Commission Deputy Director General for Research & Innovation, opened the conference stressing the role of fundamental research and the importance of this endeavour for strengthening Europe's leading role in the global landscape. Moreover, in his keynote speech Mr Herman van Rompuy (President Emeritus of the European Council and former Prime Minister of Luxemburg) discussed the challenges lying ahead for Europe and the value of investments in fundamental science to tackle them.



Dr. Wolfgang Burtscher, the European Commission's Deputy Director General for Research & Innovation, opens the Future Circular Collider (FCC) week 2019 in Brussels, Belgium. (Image: CERN)

This year's meeting marks the final event of the Horizon 2020 EuroCirCol project, tightly integrated with the FCC study research programme. EuroCirCol focused on key enabling technologies for an energy-frontier 100 TeV collider (FCC-hh). Results from the ongoing R&D programme were presented, demonstrating the feasibility of this new machine, identifying future research paths, and stimulating global collaborations to successfully pursue these goals.

More specifically, the EuroCirCol Work Package 5 has successfully achieved the objective of feeding the FCC Conceptual Design Report (CDR) with a design and cost model for magnets that could meet the FCC requirements, once properly developed, by taking into account the electromechanical characteristics of the conductor. The FCC magnet development programme, strongly supported by the EU Horizon 2020 programme, has been extremely important in boosting worldwide efforts, fostering strong collaborations with USA, Japan and Russian institutes. Furthermore, impressive progress has been made in the performance of the Nb3Sn superconducting wires, as shown in numerous sessions during the FCC week. Two promising developments have been the 14T magnetic field achieved at Fermilab, surpassing the previous record of 13.8 Tesla for accelerator niobium-tin magnets, and the reach of the critical current density Jc = 1500 A mm-2 required for the FCC wires.

The successful implementation of the FCC also relies on the work of the so-called infrastructures and operation group (IO, in short), which covers a wide field of different aspects, comprising civil

engineering, integration, cryogenics, electricity distribution, cooling, ventilation, safety, and many others. Three parallel sessions were devoted to IO related matters. One complete session dealt with cryogenics; one was devoted to implementation aspects, comprising civil engineering, as well as administrative activities; and one session focused on matters of safety and technical infrastructure. The focus of the latter was on optimizing the footprint, getting the administrative processes underway, and planning preparatory works like geodetic modeling and site investigations, among various others.



A number of parallel sessions and a dedicated poster session offered the opportunity for liverly and fruitful discussion during the FCC week 2019. (Image: CERN)

A wide range of presentations focused on a future circular lepton collider (FCC-ee). Results testify to the technological readiness of FCC-ee. These, combined with progress in the design of beam optic and interactions regions, confirm the feasibility of this new machine, which could be operational by the mid-2030s. Recent studies contribute to further boost its performance, for example, by increasing the number of collision points or by introducing concepts of energy recovery and positron recycling. The time window opened by FCC-ee will also enable the research community to push the limits of novel technologies to steer the more energetic beams of FCC-hh, reaching energies eight times higher than LHC, in an affordable way, within the 21st century.

The FCC week offered an in-depth review of the work done since the kick-off meeting in 2013. These results have been documented in the four-volume FCC Conceptual Design Report published earlier in 2018. The four volumes of the FCC CDR were presented during the FCC Week 2019 in Brussels, Belgium. In a special ceremony, on the first day of the conference, Christian Caron (Executive Editor for the European Physical Journal (EPJ) at Springer Nature) handed over the four volumes to Fabiola Gianotti (CERN's Director General), Frédérick Bordry (CERN's Director of Accelerators & Technologies) and Michael Benedikt (FCC study leader).

"The FCC design report is the outcome of the common effort of more than 1.350 contributors from 34 countries including academic and industrial partners. I would like to thank each and every participant for helping to develop a global vision and preparing the construction of this unique facility, which will serve the worldwide high-energy physics community throughout the 21st century. Together, we will continue reviewing the experimental challenges and exploiting opportunities for technological breakthroughs towards the realisation of these machines," said Michael Benedikt (FCC study leader).

Precision studies of the Higgs boson, along with a number of other electroweak observables, set a clear experimental challenge for a post-LHC collider. In his keynote talk on "FCC and the Future of Fundamental Physics", Nima Arkani Hamed from Princeton's Institute of Advanced Studies highlighted the importance of scrutinizing the Higgs boson properties, given its unique nature compared to all other known particles of the Standard Model. Finally, a number of presentations also highlighted the potential for studying the strong interaction through heavy-ion collisions and for detailing the parton distribution inside protons with a proton-electron interaction point.

The socio-economic impact of RIs was another key point of the conference, given the required large-investments necessary to these facilities. A dedicated workshop on the "Economics of Science" was held during the second day of the FCC week. Experts on cost-benefit analysis shared lessons with representatives from CERN and other major European research organisations, including SKA, ESA and ESS.



Thierry Lagrance, Head of CERN's Industry, Procurement and Knowledge Transfer department, opened the dedicated workshop on the Economics of Science, stressing the role of fundamental science for the future of our society. (Image: CERN)

Further interactions on how to maximise the benefits of large-scale research facilities took place throughout the day. The workshop concluded with a round-table discussion "Investing in Fundamental Science: For whom?" with the participation of Dr. Philip Amisson (STFC), Professor Massimo Florio (University of Milano), Professor Michela Massimi (University of Edinburgh), and Professor Carsten Welsch (University Liverpool). The workshop attracted a large, particularly diverse audience, creating a new space for future collaboration in this field.

You can watch the recording of the Opening and Plenary sessions of the FCC week HERE