

Highlights of half a century

A symposium at CERN provided an informal but fascinating history of half a century in particle physics, with personal recollections giving a real “inside story”.

When CERN’s LHC came back to life on 20 November 2009, it was almost exactly 50 years since the first beam circulated in the Proton Synchrotron (PS). In the intervening years, theorists and experimentalists discovered and developed all of the elements of today’s Standard Model of particles and forces. Key players from these five remarkable decades, including 13 Nobel laureates, came together for the symposium, “From the PS to the LHC: 50 years of Nobel Memories in High-Energy Physics”, held at CERN on 3–4 December. Like a family reunion that offers glimpses into old photo albums, the occasion brought past glories to life, in particular for the younger members of the audience.

The first afternoon focused on CERN, from the PS to the LHC. Günther Plass highlighted the many ways in which the PS has evolved and improved, right up to the present as this remarkable machine remains a key link in the injection chain for the LHC. Jack Steinberger, who received the Nobel prize in 1988 for his part in the discovery of two neutrinos at Brookhaven in 1962, looked back to some of the early physics at the PS, in particular recalling experiments on CP violation and the discovery of weak neutral currents in Gargamelle (*CERN Courier* November 2009 p11).

Both Plass and Steinberger acknowledged the outstanding work of Simon van der Meer, which included the invention of the neutrino horn and the technique of stochastic cooling that was vital to converting CERN’s Super Proton Synchrotron (SPS) to a proton–antiproton collider. Carlo Rubbia spoke of the background to this daring project, which led to the discovery of the W and Z bosons in 1983 – and the Nobel prize for van der Meer and Rubbia in 1984.

CERN later turned to electron and positrons with the Large Electron Positron (LEP) collider, which – with its 27 km circumference – was the world’s biggest accelerator. Emilio Picasso, LEP project leader, looked back at the many challenges that were overcome in



Some of the galaxy of speakers, left to right: Rolf Heuer, Leon Lederman, Lyn Evans, Jerome Friedman, Burton Richter, Gerardus ’t Hooft, Sheldon Glashow, Martinus Veltman and David Gross.

the construction of the mammoth machine, while Steve Myers described its great operational success, which was not without its own challenges. Burt Richter also spoke about LEP, recalling early ideas developed during a year’s sabbatical at CERN in 1976 – the year he received the Nobel prize for the discovery of the J/psi particle at SLAC. In addition he looked to the future of particle accelerators, pointing out that physics should dictate the energy – a lead that will come from the LHC. Lyn Evans, LHC project leader, looked back at crises during construction and commissioning before finishing with news of the successful start-up (p24). CERN’s director-general, Rolf Heuer, then looked forwards to what lies in store for CERN in the coming years.

The second day of the symposium focused on 50 years of developments in particle physics, seen through the eyes of a further 10 Nobel laureates who have all contributed to today’s Standard Model. On the experimental side, Leon Lederman, who shared the 1988 Nobel prize with Steinberger and Mel Schwartz, helped to uncover the different generations of particles, with discoveries of the muon-neutrino and the bottom quark. Jim Cronin and his colleagues turned ideas upside down by finding CP violation in 1964, which led to the Nobel prize in 1980 and seems to depend on there being six kinds of quark.

Fifty years ago, quarks were unheard of, but the experiments at SLAC recalled by Jerome Friedman made them real and earned him and his colleagues the Nobel prize in 1990. Sam Ting, who shared the 1976 Nobel prize with Richter, described his latest experiment, the ground-breaking Alpha Magnetic Spectrometer, which is taking particle physics into space (*CERN Courier* October 2009 p7).

The first Nobel prize for the theory of the Standard Model was awarded to Sheldon Glashow, the late Abdus Salam and Steven Weinberg in 1979. At the symposium both Glashow and Weinberg (via video link) looked back on some of the work that led to their unification of weak and electromagnetic forces. This relied on the theory being renormalizable, as demonstrated by the work of Gerardus ’t Hooft and Martinus Veltman who received the Nobel prize in 1999 and who highlighted different aspects of their work at the symposium. David Gross and Frank Wilczek, Nobel laureates in 2004, were two key figures in establishing the strong interaction side of the Standard Model with the theory of quantum chromodynamics. Their contributions to the symposium ensured a well rounded coverage of events over a remarkable five decades.

● For all of the presentations at the symposium, see <http://indico.cern.ch/conferenceDisplay.py?confId=70765>.

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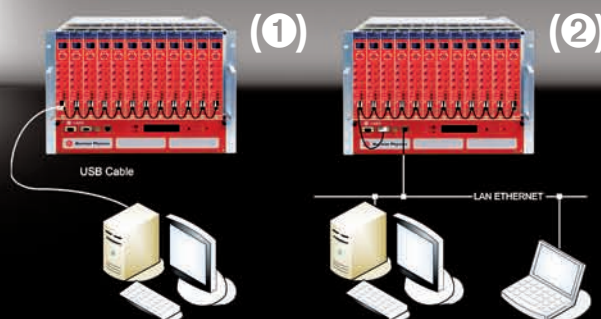
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