Newsletter Focus

SEVENTY YEARS OF ITALY AT CERN

Trust, an all-human feeling that causes us to place expectations and hopes in ourselves, others and the future; a feeling so impetuous that it can give rise to a unique and unrepeatable scientific institution: CERN. That is how, in the early 1950s, the world's largest particle physics laboratory came into being, one act of trust at a time: trust that European countries, still torn apart by the recent world conflict, would find common ground in the immutable laws of the universe; trust that substantial investments in fundamental physics could contribute to Europe's economic and social renaissance; trust that by engaging in the breakdown of matter into its smallest elements, the particles, the European scientific community, largely still on the other side of the Atlantic Ocean, could be rebuilt.

The convention for the establishment of the European Organization for Nuclear Research, CERN, which came into force on 29 September 1954, set out to build a shared science in which "the results of experimental and theoretical work shall be published or otherwise made generally available". This goal, initially embraced by 12 founding States, including Italy, now unites 24 Member States and a vibrant community of 17,000 people of more than 110 nationalities. The Italian one, widely represented in the active experiments, has accompanied the Organisation from the outset, and we owe not only our immediate joining of the project, but also a key role in its conception to the stubbornness of one of the boys from Via Panisperna, Edoardo Amaldi.

Indeed, Amaldi had taken charge in Italy of restoring the prestige of the Italian physics school: he refused a professorship in the United States, did his best to seek private funds, promoted the construction of a cosmic ray laboratory on the Matterhorn, the "Testa Grigia," and was among the founders of the National Institute for Nuclear Physics (INFN), which was founded in 1951. He realised, however, that a breakthrough for high-energy physics in Italy and Europe would come only with large shared infrastructures, a large European laboratory. In 1952 he was app ıd performed the crucial task of overcoming the scie ıg the project.

Fro clotron (SC), only four years passed, and the first dis eriment: pion decay. Predicted but never hith undamental forces and made the name of CERN anc l the world.

Giu ing SC experiments, were among the first Italian phy f the laboratory's life and continued, even after the *souriante*, "with a smiling patience" to quote physicist Ugo Amaldi, Edoardo's son, dispensing explanations, anecdotes, and advice. In other words, they nurtured

what Carlo Rubbia, director of CERN from 1989 to 1993, called CERN's "sum plus", that thriving climate in which the combination of intelligences and talents produced far more remarkable results than the sum of individual contributions would have produced.

Indeed, in an interview that is part of the Infinitely CERN collection, Rubbia describes the enterprise that won him the Nobel Prize as "the tip of the iceberg of a wonderful adventure, to which a great many people contributed", and which began at least two decades earlier. Dating back to the 1960s is the theorisation of the electroweak force and its mediating particles; to the early 1970s, with CERN's giant bubble chamber, Gargamelle, the proof of this unified force; to 1976 the insight that the conversion of the Super Proton Synchrotron (SPS), then CERN's largest accelerator, into a proton-antiproton collider would produce collisions of sufficiently high energy to succeed in producing the elusive mediating particles of the electroweak interaction, still missing from the picture. Thus came their discovery: in 1983, the UA1 and UA2 detectors announced the observation of the W and Z bosons. At the head of UA1 was indeed the Italian Carlo Rubbia.

For Rubbia, a period full of successes and celebrations began: the discovery in 1983, the subsequent Nobel Prize in 1984, the inauguration, as newly elected director of CERN, of the largest particle collider ever built, the Large Electron-Positron Collider (LEP), in 1989. Measuring 27 kilometres in circumference, a hundred metres beneath the Gex Plain, straddling the Swiss-French border, the LEP was an unprecedented feat of civil engineering and, in its 11 years of operation, made it possible to precisely measure the properties of the W and Z bosons and to verify the Standard Model, the theory describing elementary particles and their interactions. When it was decommissioned to make way for a more powerful collider, the Large Hadron Collider (LHC), LEP recorded a signal, in which many discerned the trace of a very special particle that still remained elusive: the Higgs boson.
The LHC project had been approved years earlier and was to occupy the same tunnel as LEP; there was no way the two colliders could coexist. But the signal questioned everything. A crack opened between what part of the community was calling for - delaying the installation of the LHC - and the costs in economic, time, and even credibility terms that such a move would entail. The final decision was taken by Luciano Maiani, elected director of CERN in 1999, who recalls the deep silences, the pressures, and the tears of the researchers that punctuated those months, and a poem by Robert Frost, learned from his colleague Giuseppe Cocconi, that ended as follows: "Two roads diverged in a wood, and I – I took the one less traveled by, and that has made all the difference".
Maiani took the less traveled road, with the knowledge that LEP did not have sufficient energy and brightness to discover the Higgs boson. And although some continued to oppose his decision and "forget" LEP's power cables connected, with determination Maiani persevered. LEP was decommissioned in 2001 and LHC came into operation in 2008; four years later Fabiola Gianotti, who would become director of CERN in 2016, and Joseph Incandela, then in charge of the ATLAS and CMS experiments, announced the discovery of the Higgs boson. Peter Higgs, who had the
llowing year, and the INFN community, the
inst
N's research activities, celebrated the milestone
as a
CEF
batomic world, while some were already
por
nd more collisions: work on the High
Lur
Italian technical and scientific contribution, is
exp
ng at an even more distant future. Because we
still
gate, and CERN's 70th anniversary is just an
opp
renew our faith in a very bright future together.

[This contribution, by Antonio Zoccoli, INFN President, was published in lescienze.it, 1 October 2024, on the occasion of CERN's 70th anniversary celebration]