

Viewpoint

The 1980s: spurring collaboration

Herwig Schopper recalls a decade of growth at CERN.



The 1980s were characterized by two outstanding achievements that were to influence the long-term

future of CERN. First came the discovery of the W and Z particles, the carriers of the weak force, produced in proton–antiproton collisions at the Super Proton Synchrotron (SPS) and detected by the UA1 and UA2 experiments. These were the first, now-typical collider experiments, covering the full solid angle and requiring large groups of collaborators from many countries. The production of a sufficient number of antiprotons and their handling in the SPS underlaid these successes, which were crowned by the Nobel Prize awarded to Carlo Rubbia and Simon van der Meer in 1984.

Then came the construction and commissioning of the Large Electron–Positron (LEP) collider. With its 27 km tunnel, it is still the largest collider of this kind ever built. Four experiments were approved – ALEPH, DELPHI, L3 and OPAL – representing again a new step in international co-operation. More than 2000 physicists and engineers from 12 member states and 22 non-member states participated in the experiments. Moreover, most of the funding of several hundred million Swiss francs had to come from outside the organization. CERN contributed only about 10% and had practically no reserves in case of financial overruns. Therefore the collaborations had to achieve a certain independence, and had to learn to accept common responsibilities. A new “sociology” for international scientific co-operation was born, which later became a model for the LHC experiments.

A result of the worldwide attraction of LEP was that from 1987 onwards, more US physicists worked at CERN than particle physicists from CERN member states at US laboratories. In Europe, two more states joined CERN: Spain, which had left CERN in 1968, came back in 1983, and Portugal joined in 1985. However, negotiations at



Herwig Schopper in 1982: with LEP a “new ‘sociology’ for international scientific co-operation was born”. (Image credit: CERN-PHOTO-8205525.)

the time with Israel and Turkey failed, for different reasons.

But the 1980s also saw “anti-growth”. Previously, CERN had received special allocations to the budget for each new project, leading to a peak around 1974 and declining afterwards. When LEP was proposed in 1981, the budget was 629 million Swiss francs. After long and painful discussions, Council approved a constant yearly budget of 617 million Swiss francs for the construction of LEP, under the condition that any increase – including automatic compensation for inflation – across the construction period of eight years was excluded. The unavoidable consequence of these thorny conditions was the termination of many non-LEP programmes (e.g. the Intersecting Storage Rings and the bubble-chamber programme) and a “stripped down” LEP project. The circumference of the tunnel had to be reduced, but was maintained at 27 km in view of a possible proton–proton collider in the same tunnel – which indeed proved to be a valuable asset.

A precondition to building LEP with decreasing resources was the unification of CERN. CERN II had been established in 1971 for construction of the SPS, with its own director-general, staff and management. From 1981, CERN was united under one director-general, but staff tended to adhere to their old groups, showing solidarity with their previous superiors and colleagues. However, for the construction of LEP, all of CERN’s resources had to be mobilized, and about 1000 staff were

transferred to new assignments.

Another element of “anti-growth” had long-term consequences. Council was convinced that the scientific programme was first class, but had doubts about the efficiency of management. An evaluation committee was established to assess the human and material resources, with a view to reducing the CERN budget. In the end, the committee declined to consider a lower material budget because this would undoubtedly jeopardize the excellent scientific record of CERN. They proposed instead a reduction of staff from about 3500 to 2500, through an early retirement programme, and during the construction of the LHC this was even lowered to 2000. However, to cope with the increasing tasks and the rising number of outside users, many activities had to be outsourced, so considerable reduction of the budget was not achieved.

Yet despite these limiting conditions, LEP was built within the foreseen time and budget, thanks to the motivation and ingenuity of the CERN staff. First collisions were observed on 13 August 1989.

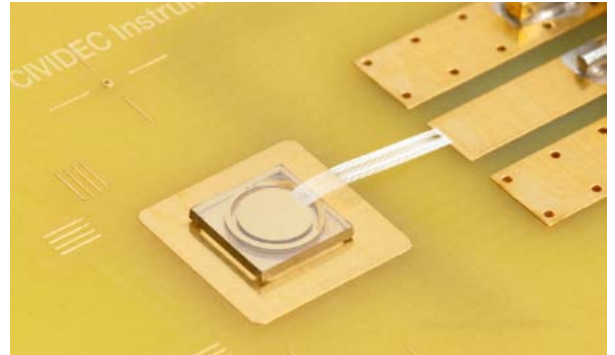
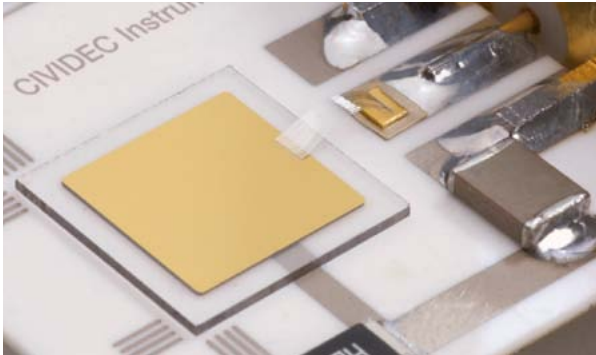
The theme of CERN’s 60th anniversary is “science for peace” – from its foundation, CERN had the task not only to promote science but also peace. This was emphasized at a ceremony for the 30th anniversary in 1984, by the American physicist and co-founder of CERN, Isidor Rabi: “I hope that the scientists of CERN will remember... [they are] as guardians of this flame of European unity so that Europe can help preserve the peace of the world.” Indeed during the 1980s, CERN continued to fulfil this obligation, with many examples such as co-operation with East European countries (in particular via JINR, Dubna) and with countries from the Far East (physicists from Mainland China and Taiwan were allowed to work together in the same experiment, L3, on LEP). Later, CERN became the cradle of SESAME, an international laboratory in the Middle East.

Unavoidably, CERN’s growth into a world laboratory is changing how it functions at all levels. However, we can be confident that it will perform its tasks in the future with the same enthusiasm, dedication and efficiency as in the past.

● *Herwig Schopper, CERN director-general, 1981–1988.*

CIVIDEC Instrumentation is a R&D company born from the cutting-edge technology of CERN. We specialise in turn-key solutions for beam diagnostics based on CVD diamond technology.

Diamond Detectors



Beam Loss Monitors

Our beam loss monitors provide bunch-by-bunch loss information with 1 ns time resolution. Single particles can be resolved as well as $1\text{E}9$ particles per bunch. The diamond detectors and the front-end electronics are radiation resistant.

Alpha-Spectroscopy

We provide state-of-the-art solutions for alpha-spectroscopy and use them for neutron detection as Helium-3 replacement.

Fast Neutron Monitoring

Our diamond detectors are proven to operate at cryogenic as well as high temperatures for the detection of fast neutrons.

Electronics

We provide **Broadband Current Amplifiers** with 2 GHz analogue bandwidth, a noise figure of 3.5 dB and a gain of 20 dB or 40 dB, **Fast Charge Amplifiers** with a gain of 4 mV/fC, a Gaussian pulse shape with 10 ns FWHM and 1000 electrons noise, and the famous **Spectroscopic Shaping Amplifiers** with a gain of 8 mV/fC, a Gaussian pulse shape with 180 ns FWHM and $(300 + 40/\text{pF})$ electrons noise.

Readout Systems

Our digital readout system **ROSY®** uses a 5 GS/s ADC with 8 bit resolution, a FPGA-driven real-time processing unit and an embedded Linux server with Ethernet connection.

WE PIONEER CUSTOMIZED SOLUTIONS

CIVIDEC Instrumentation GmbH | Vienna

Multichannel Waveform Digitizers

The 730 Family 8/16 Ch. 14-bit 500 MS/s

Available in three form factors: VME, NIM, Desktop

On Line Digital Pulse Processing (DPP)

- Pulse Height Analysis
- Pulse Shape Discrimination
- Zero Length Encoding



**Multi-Board
Oscilloscope Tool**

CAEN
Tools for Discovery

730 Digit Family web page >>>



Small details... Great differences



CERN COURIER

VOLUME 54 NUMBER 3 APRIL 2014

Contents

- 5 **NEWS**
- *LSI: on the home straight* ● *Tevatron experiments find missing piece in top-quark puzzle* ● *CDMS puts new constraints on dark-matter particles* ● *Beauty-quark decays reveal photon polarization* ● *First observation of Z-boson production via weak-boson fusion* ● *Heavy stable charged particles: an exotic window to new physics* ● *New results mark progress towards polarized ion beams in laser-induced acceleration* ● *NOvA experiment sees its first long-distance neutrinos* ● *New precision reached on electron mass*

11 **SCIENCEWATCH**

13 **ASTROWATCH**

15 **ARCHIVE**

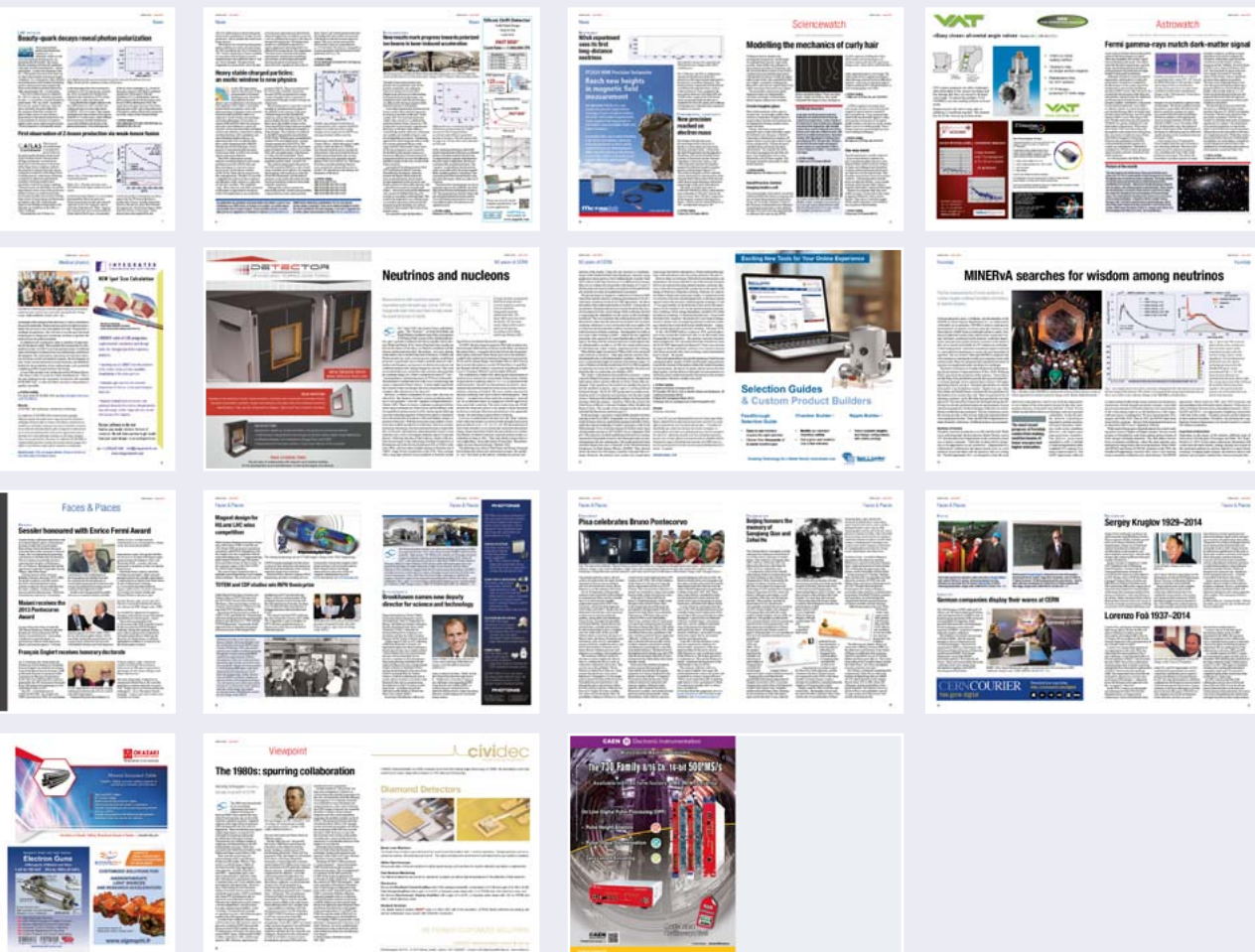
FEATURES

16 **The Future Circular Collider study**
Options for an energy-frontier

19 **ICTR-PHE: uniting physics, medicine and biology**
A conference to discuss advances

23 **Neutrinos and nucleons**
A look back at measurements of

26 **MINERvA searches for wisdom**
Precise measurements of cross-sections in neutrino physics at Fermilab.



ready
r collider in the post-LHC era.

medicine and biology
ed techniques to fight cancer.

that helped to reveal quarks.

among neutrinos
s-sections continue a rich history of

31 **Advanced radiation detectors in industry**
The EPS-TIG meeting looked at applications ranging from medicine to materials science.

35 **FACES&PLACES**

43 **RECRUITMENT**

47 **BOOKSHELF**

50 **VIEWPOINT**

WELCOME

CERN Courier – digital edition

Welcome to the digital edition of the April 2014 issue of *CERN Courier*.

It is 60 years since a proton beam was first used to treat cancer at the Berkeley cyclotron. Since then, research has spread to other countries and other beams, notably carbon ions. In February, experts at the ICTR-PHE 2014 conference in Geneva discussed current progress in using these and other techniques derived from nuclear and particle physics in the service of medicine.

It is 80 years since two theoretical physicists first calculated the neutrino cross-section and concluded that “there is no practically possible way of observing neutrinos”. Forty years later, measurements of neutrinos by the Gargamelle team at CERN helped to reveal the quark structure of matter. Now, another 40 years later, the MINERvA experiment at Fermilab continues a long tradition at the two labs in studying neutrinos.

To sign up to the new-issue alert, please visit:

<http://cerncourier.com/cws/sign-up>.

To subscribe to the magazine, the e-mail new-issue alert, please visit:

<http://cerncourier.com/cws/how-to-subscribe>.