Miscellany

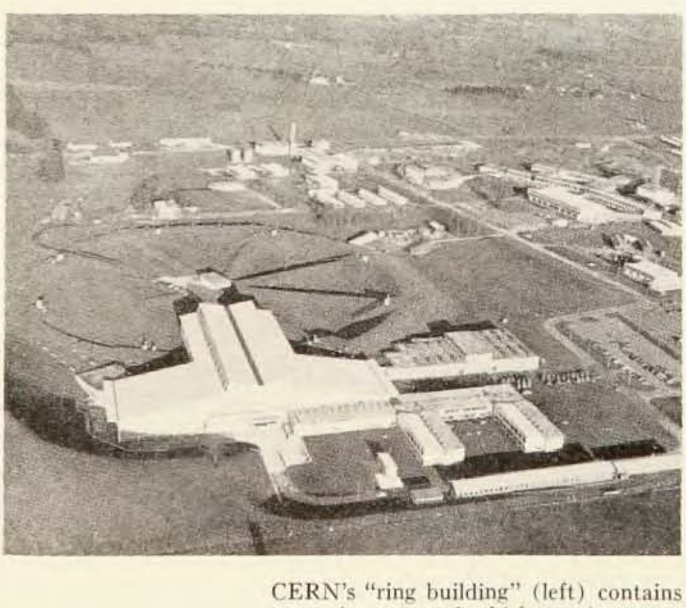
Great Leap Forward, CERN Style

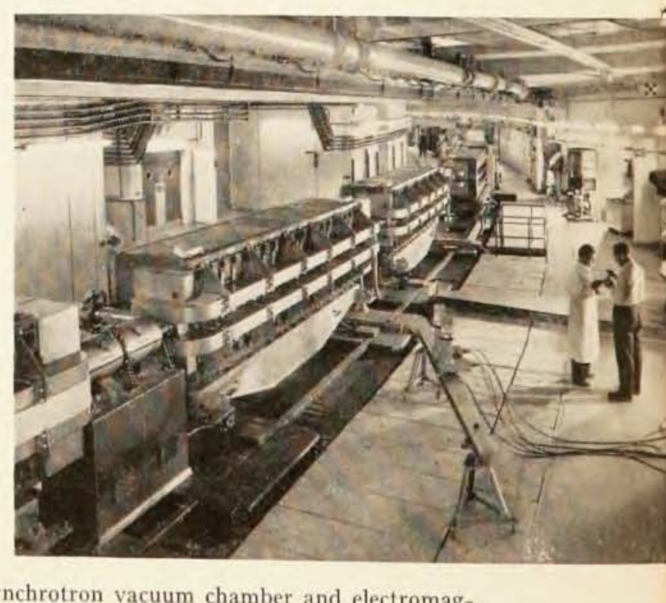
CERN, the European Organization for Nuclear Research, formally dedicated its new proton synchrotron on February 5 at the CERN site near Geneva in Switzerland. The ceremony was held in the South Experimental Hall of the building housing the giant accelerator, and the symbolic gesture of inauguration was performed by Niels Bohr of Denmark who, by pushing the appropriate button, opened a channel for the proton beam to pass through the concrete shielding wall which separates the synchrotron proper from the adjacent South Experimental Hall.

The synchrotron was placed in full operation on November 24th of last year, when it was announced that the beam had been accelerated to about 24 billion electron volts. Two weeks later, after the shape of the magnetic field had undergone some readjustment at field values above 12 000 gauss, the kinetic energy of the proton beam was increased to a maximum of 28.3 Bev, thus exceeding the original 25-Bev goal set in 1953 by the organization's Council. At its highest energy, the intensity of the accelerated beam was found to be 10^{10} protons per pulse (ten times higher than expected) and no loss of particles was experienced during the period of acceleration. Protons are injected into the synchrotron at an energy of 50 Mev from a linear accelerator capable of producing intensities up to a 5-mA peak. The initial acceleration is accomplished in a 500-kev Cockcroft-Walton machine. After being injected into the vacuum chamber of the synchrotron, a ring-shaped structure 628 meters in circumference, the accelerating protons are guided by 100 magnetic units into an orbiting beam 200 meters in diameter. The precision of the beam-control system is indicated by preliminary measurements showing that the beam moves no more than one centimeter from the center of the vacuum chamber during the acceleration cycle. At maximum energy the velocity of the accelerated particles reaches 99.94% of the speed of light and the proton's increase in mass is 25 times. When put to serious experimental use, the beam of heavy, high-energy protons will bombard targets in the vacuum chamber itself or may be ejected and channeled through the shielding wall for studies conducted in one or another of the two large experimental halls.

At least temporarily, CERN's achievement has given Europe the satisfaction of possessing the world's most powerful accelerator. The energy of the CERN machine exceeds that of its closest competitor, the Soviet synchrophasotron at Dubna, by nearly three times, and it is nearly five times more energetic than the Berkeley bevatron. The standings, projected into the foreseeable future, are indicated by the accompanying score card.

The cost of the CERN proton synchrotron has been estimated at $28 million, a financial outlay about twice the size of the organization's current annual budget. These funds are supplied by its thirteen Member States, and the size of each nation's contribution is based upon its national income. Their relative financial participation can be seen in the following percentage figures: Austria (1.93), Belgium (4.15), Denmark (1.99), France (21.22), German Federal Republic (19.52), Greece (1.17), Italy (10.09), Netherlands (3.85), Norway





CERN's "ring building" (left) contains synchrotron vacuum chamber and electromagnet units, some of which can be seen at right on their shock-proof supporting girder.

Accelerator	Max energy GeV	Mean intensity Particles per sec.	Completion date
Brookhaven proton synchrotron (COSMOTRON)	3	2.10^{10}	1952
Saclay proton synchrotron (SATURNE)	3	10^{10}	1958
Princeton-Pennsylvania proton synchrotron	3	2.10^{12*}	1960
Berkeley proton synchrotron (BEVATRON	6	2.10^{10}	1954
Rutherford Laboratory proton synchrotron (NIMROD)	7	10^{12*}	1961/62
Russian A.G. proton synchrotron	7	$\approx 2.10^{9*}$	1960
Russian proton synchrotron (Synchrophasotron)	10	$\approx 10^{9}$	1957
Australian proton synchrotron	10	10^{7*}	1962/63
Argonne zero gradient proton synchrotron	12.5	2.10^{12*}	1962
CERN proton synchrotron	28 25 6-10	2.10^{9} 3.10^{9} 10^{10}	1959
Brookhaven A.G. proton synchrotron	30	$\approx 3.10^{9*}$	1960
Russian A.G. proton synchrotron	50	$\approx 10^{9*}$	1961/62

Comparison of proton accelerators in operation or under construction is given in table compiled by CERN. Energies are given in giga (10^9) electron volts. Asterisks indicate target figures.

(1.61), Sweden (4.23), Switzerland (3.29), United Kingdom (25.00), and Yugoslavia (1.95).

As an experiment in international scientific cooperation, CERN has been a glowing success. The foresight of its planners, the enthusiasm of its staff, and the quality of its research equipment have combined in providing the European community with one of the world's great centers of fundamental nuclear research. It is doubtful whether any single Member State might have realized such an achievement alone, even if it could have afforded the financial burden involved, for CERN's strength comes from the combined efforts of talented scientists from many countries. This view has been widely expressed, but was stated perhaps most succinctly and optimistically by E. Amaldi of Italy, the chairman of CERN's Scientific Policy Committee, in speaking at the inaugural ceremony. "We know," Professor Amaldi said, "that this success is due to the research ability of the new generation, but also that it has its roots in the unimpaired scientific tradition of Europe which found new stimulus for development and which will flourish in the future in an atmosphere of cooperation between many countries on an unprecedented scale. We know that CERN is not only the result of the efforts of thirteen nations to solve technical and scientific problems that would far exceed the resources of any single European country. It is also the meeting point of scientists working in their national institutions. The simple existence of CERN has greatly stimulated the construction of accelerators in many national institutions of the Member States, while a larger part of the work done in the CERN laboratory is due to teams coming from national institutes with their own equipment. The exchange of ideas between the CERN physicists and physicists from national institutes constitutes the basis on which the research program is ultimately worked out."

Science Education

The National Science Foundation is sponsoring sixteen Summer Conferences for College Teachers of Science and Mathematics this year, of which five are open to physics teachers. The programs are designed to give a better understanding of new scientific developments and to help increase teaching effectiveness in the classroom. Participants will receive travel allowances plus stipends (up to $15 a day) and will not have to pay tuition or fees. Applications for the following programs, which are open to physics teachers, should be made directly to the schools.

Carleton College will present (from June 19 to July 1) a conference in solid-state physics for teachers of undergraduate college physics who have had no formal training in solid-state physics. Six outstanding physicists will present an introduction to selected areas. Robert A. Reitz of Carleton will serve as conference director. Applications should be sent to Prof. William A. Butler, Department of Physics, Carleton College, Northfield, Minn.

Cornell College will offer a conference on radioisotopes and their uses (June 13–24) for college and junior college teachers of physics, chemistry, and biology. This program is aimed at helping participants to gain sufficient background in radioisotope techniques to enable them to introduce some of this technology into their own undergraduate courses. Apply to Dr. Cecil F. Dam, Physics Department, Cornell College, Mt. Vernon, Iowa.

The University of Detroit conference topic is graphics in scientific engineering. Open to college and university teachers of engineering graphics, mechanics, physics, and mathematics, the conference discussions (July 11–22) will involve graphical solutions of mathematical and scientific problems and will be conducted by educational and industrial engineering personnel. Apply to Prof. Paul M. Reinhard, Chairman, Department of Engineering Graphics, University of Detroit, Detroit 21, Mich.

The University of Florida conference (June 7–18) will deal with nuclear resonance and is open to college teachers of physics and chemistry with at least two years of experience. It will be devoted to the principles, instrumentation, and applications of nuclear magnetic and quadrupole resonance. Lectures by experts and some laboratory work will be included. Apply to Dr. Wallace S. Brey, Jr., Department of Chemistry, University of Florida, Gainesville, Fla.

Georgetown University will conduct its conference (August 1–24) on recent advances in astrogeophysics for college teachers of physics and astronomy. Included in the subjects of the lectures, to be given by experts, are satellite tracking, radio astronomy, planetary spectra, high-altitude balloons, lunar surface, rocket studies, cosmic rays, and interstellar medium. In addition there will be observational and experimental work at the Observatory with telescopes, computers, spectrographs, etc. Visits to research centers in the Washington area will also be included. Applications should be sent to Rev. M. P. Thekaekara, S.J., Director Summer Conference, Georgetown University, Washington 7, D. C.

Grants have been awarded to a large number of educational and research institutions under three other NSF summer institute programs, including the institutes for elementary-school supervisors and teachers, the research participation for teacher training program, and