

mathematical models. Having devised a formula based on a novel theory, the physicist computes theoretical curves for some function that can be compared with experimental results.

Operation

The Data Handling Division, which actually has CERN's central computers under its charge, contains a number of professional programmers, mostly mathematicians by training. Some of these are responsible for the 'systems programmes', that is, the Fortran compiler and its associated supervisor programme. Some have the job of disseminating programming knowledge, helping individual users of the computer, and writing programmes for people in special cases. Others are semi-permanently attached to various divisions, working on particular experiments as members of the team.

A small number of mathematicians are also engaged in what might be called 'specialist computer research', covering such things as list-programming languages and methods of translating from one programme language into another. Such work might be expected to yield long-term profits by giving increases in computing power and efficiency.

As at all large computing installations, computer programmers at CERN do not operate the machine themselves. Data and programmes are submitted through a 'reception office' and the results are eventually available in a 'computer output office', leaving the handling and organizing of the computer work-load, and the operating of the machine, to specialist reception staff and computer operators in the Data Handling Division.

What of the future of computers at CERN? In a field as new as this, predictions are even more dangerous than in others, but it is clear that the arrival of the new computer at the end of the year will cause a great change in the way computers are used. Having ten peripheral processors, each of which is effectively an independent computer, the machine may have many pieces of equipment for data input and output attached to it 'on-line'. The old concept that a computer waiting for the arrival of data is standing idle, and that this is therefore wasteful and expensive, need no longer be true. With the new system, a computer that is waiting for new data for one problem is never idle, but continues with calculations on others. Every moment of its working day is gainfully employed on one or other of the many problems it is solving in parallel. Even so, there will still be a need for a number of smaller computer installations forming part of particular experiments.

As M.G.N. Hine, CERN's Directorate Member for Applied Physics, pointed out at a recent conference*, even with the growth of such facilities, the amount of computing time available may one day dictate the amount of experimental physics research done at CERN, in much the same way as the amount of accelerator time available dictates it now ●

* Informal meeting on filmless spark chamber techniques and associated computer use, CERN, 3-6 March 1964.

News from abroad

'Nimrod' inaugurated

Friday 24 April saw the inauguration of 'Nimrod', the 7-GeV proton synchrotron at the Rutherford High Energy Laboratory at Chilton, U.K., and the official opening of the Laboratory itself, by the United Kingdom Secretary of State for Education and Science, the Rt. Hon. Quintin Hogg. Among many distinguished guests from the field of high-energy physics was our own Director General, Prof. V.F. Weisskopf, who, in particular, welcomed the new accelerator as part of the world effort to penetrate into the secrets of nature.

The Rutherford High Energy Laboratory is the first establishment of the National Institute for Research in Nuclear Science, which was set up in 1957 by the British Government to provide for common use by universities and others the expensive research facilities required in areas such as high-energy physics and nuclear physics and which are beyond the resources of individual institutions. In this sense it does for British universities what CERN does on a wider scale for the European ones (including the British, of course). The laboratory, with Dr. T. G. Pickavance as Director, is situated in Berkshire, next to the Atomic Energy Research Establishment at Harwell.

Nimrod was begun in 1957 and was intended from the beginning to be a complementary machine to the CERN PS, giving lower energy but higher intensity. Its design energy was chosen as 7 GeV so as to be reasonably far above the threshold for the production of antiprotons, and the well-established 'weak-focusing' principal was used as there was much doubt then whether the required intensity could be reached with a 'strong-focusing' design, at that time still unproved. Some brief details of the machine were given in *CERN COURIER* last September (vol. 3, no. 9, p. 113), shortly after its successful operation at full energy on 27 August 1963.

At the time of its inauguration, Nimrod was operating regularly for 3½ days per week and achieving beam intensities of 3 or 4 × 10¹¹ protons per pulse at 7 GeV. Apart from work aimed at increasing both the beam intensity, towards the expected 10¹² protons per pulse, and the operating time, a major effort was being made to develop the external proton beam, first extracted from the accelerator on 24 March this year. Six experiments were set up around the machine, and among the team leaders involved were a number of physicists who had been working at CERN during recent years. Among other experiments in preparation are some to be carried out by a collaboration between the 'Centre d'Études Nucléaires' at Saclay, French and British universities, and the Rutherford Laboratory itself. A new liquid-hydrogen bubble chamber will be used, belonging to Saclay and developed from their successful 81-cm chamber at present in use at CERN.

Nimrod is now the second most powerful proton synchrotron in Europe and the first in Britain to be capable of producing kaons, hyperons and antiprotons. Its cost, including buildings was just under £ 11 million (or rather more than that of the CERN PS). The Rutherford Laboratory also has a 50-MeV proton linear accelerator, operating since 1959, other divisions for applied physics, engineering and administration, and a separate group working on a novel

20-MeV electrostatic-generator project for Oxford University. It has a permanent staff of about 1000, and a budget (for 1963-64) of about £7 million, three quarters that of CERN.

(From information obtained by courtesy of the editor of 'Orbit'.)

Experiments at 'DESY'

Europe's largest electron accelerator, the German Electron Synchrotron, DESY, at Hamburg, is also in operation, having accelerated its first beam to full energy at the end of last February.

During last summer the high-frequency system was operated at full power, and the magnet power supply was completed after incorporating additional filter circuits to overcome some difficulties that had shown up in earlier tests. Assembly of the accelerator parts, with the exception of the vacuum system, was completed in October 1963, and component tests gave satisfactory results.

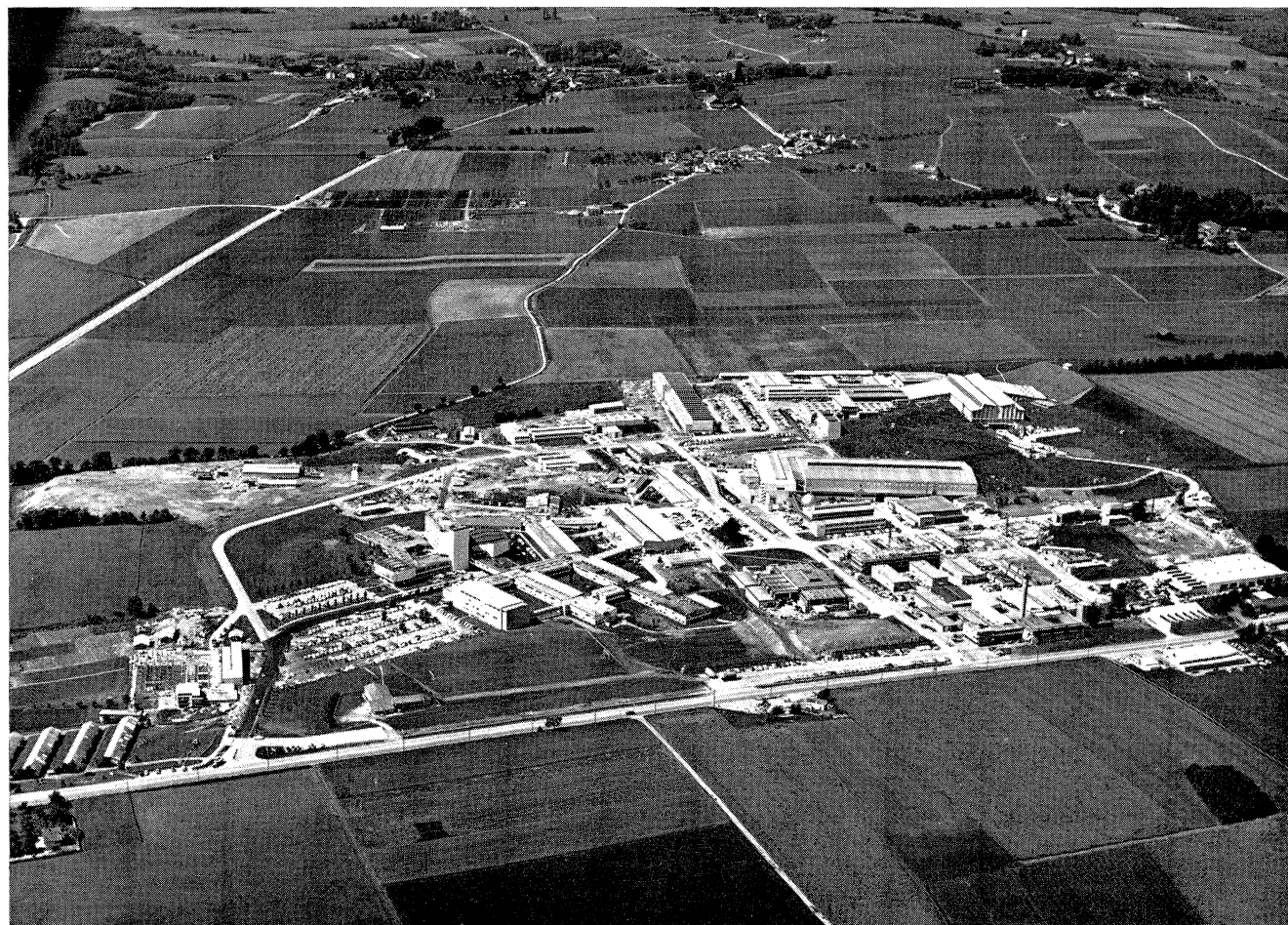
The linear accelerator, already delivered in 1961, also performed satisfactorily, and the first electron beam was injected into the magnet ring in December 1963. First attempts to accelerate electrons in the ring were made on 7 February 1964, and late on 26 February an energy of 5 GeV was reached for the first time. This was soon raised to 6 GeV, the maximum design energy.

At present the accelerator is operating at about 4.8 GeV, with an intensity of between 10^{10} and 3×10^{10} electrons per pulse ($5 - 15 \times 10^{11}$ electrons per second). Using a preliminary target, bremsstrahlung (gamma-ray) pulses up to 1.6 milliseconds long have been attained with an intensity of about 3×10^8 effective quanta per 10^{10} electrons. A pair spectrometer is being used to measure the spectrum of the bremsstrahlung. The first experimental results on the scattering of electrons by protons have also been obtained, using the internal electron beam. Measurements have been begun on the recoil protons arising from the nuclear production of gamma rays.

An 80-cm liquid-hydrogen bubble chamber has been built at the French laboratory at Saclay, with the help of French physicists and engineers, and was operated successfully there in the middle of June. This chamber, also a development of the one at CERN, is expected to be installed at DESY at the beginning of August, 1964. As further examples of the international nature of high-energy physics research, it is worth noting that the linear accelerator for DESY was supplied by an English firm, and that the whole synchrotron is closely similar to the 6-GeV Cambridge Electron Accelerator in the U.S.A., put into operation two years ago. Close co-operation has been maintained between the two laboratories concerned, and one of the senior staff of the Cambridge machine spent six months in Hamburg to see the younger one safely into service.

(Based on information kindly supplied by Prof. W. Jentschke.) ●

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Aerial view of the CERN Laboratory, taken at the beginning of June. The proton-synchrotron ring can be seen on the right. Close inspection may reveal some of the changes that have taken place since the last picture was published in CERN COURIER, in September 1963.