It is the great beauty of our science that advancement in it, whether in a degree great or small, instead of exhausting the subject of research, opens the doors to further and more abundant knowledge, overflowing with beauty and utility. — Faraday

In the USA plans, but ECFA recommended 300 GeV for Europe to avoid the increased cost, risk and above all delay which an energy higher than 300 GeV would involve.

These arguments lead to the time-scale given below for the performance of the predominant proton accelerators in different countries, in which each continent's plans fit, roughly, into a world-wide development by steps, while still preserving the essential facilities for each continent separately.

On various occasions it has been asked whether the last step, or even the one before, could not be made on an intercontinental basis, through the construction of a 'world machine'. A meeting between very senior scientists and officials from Europe, the USSR and the USA was held in Vienna in July 1964 to explore these possibilities: it appeared rather conclusively that the step to 200-300 GeV should be taken by each continent separately, but that the idea of a world-wide collaboration to build a 1000 GeV machine should not be dropped.

Meanwhile, collaboration with the USSR on a more practical scale is developing as plans are being worked out with the authorities there for physics groups and large instruments from Europe to work at Serpukhov, and for collaboration on the development of the accelerator itself. This is the consequence of a scientific liaison between CERN and several Eastern European countries, which has been growing steadily over the past years. CERN and various USSR laboratories have exchanged staff, latterly with a Russian bubble chamber group working in CERN for several months, and the Polish high-energy physics effort, which is of very high quality, is largely sustained by an active collaboration with CERN. The planned collaboration with Serpukhov will open the way for large-scale extensions in scientific contacts and exchanges with the USSR, gradually preparing the ground for very ambitious intercontinental efforts. It is important, however, to realize that this type of collaboration can only be successful with approximately equal partners: it is not a substitute for a healthy accelerator programme for each continent separately, any more than the building up of CERN can replace national accelerator construction in Europe.

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1966 Europe, USA: 30 GeV 3 \times 10^{11} \text{ protons/second}
1969 Serpukhov (USSR): 70 GeV 10^{11} \text{ protons/second}
1971 Europe, USA: Improvements to intensity of existing 30 GeV machines
1974 USA: Completion of ISR at CERN
1976 Europe: 200 GeV 10^{11} \text{ protons/second}
1980+ Europe: 300 GeV 10^{11} \text{ protons/second}
1980+ ? 1000 GeV ? \text{ protons/second}

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CERN News

Council Meeting

The 33rd Session of the Council was held at CERN on 14 and 15 December under the Chairmanship of Mr. J. H. Bannier. The agenda included the presentation by the Director General of the Progress Reports on the work of the seven CERN Departments covering the whole of 1966. This represents a change from the traditional procedure where Progress Reports were presented at each Council session covering the preceding six months. From now on, detailed reports on the full year will be prepared for the December meeting and much less detailed summaries of the first six months, for the June meeting, which coincides with the publication of the CERN Annual Report.

The budget of the basic programme for 1967 was fixed, together with a firm estimate of the budget for 1968 and provisional figures for 1969 and 1970. Two important topics for the future of sub-nuclear physics in Europe were also discussed — the proposed European 300 GeV accelerator and collaboration with the Serpukhov Laboratory in the USSR where a 70 GeV proton synchrotron is being built.

The Session will be covered in some detail in the January 1967 issue of CERN COURIER.

The experimental programme

On 16 November, a 'Discussion Meeting on the High-Energy Physics Programme at CERN' brought together a large gathering of physicists from throughout Europe who use the two CERN accelerators. The aim was to present, for information and comment, the recent, current and near-future experimental programmes on the machines.

The first speaker was Dr. Charpak, who has recently become co-ordinator of experiments at the 600 MeV synchrocyclotron. He described the situation with regard to beams and experiments at the SC (see CERN COURIER, August, p. 155).
Dr. Charpak was followed by Professor Van Hove who reviewed the physics situation especially in the light of the results of the Berkeley Conference. He listed the major areas of interest and emphasized topics where important questions are waiting for answers from experiments. Professor Gregory described the beams and experiments at the 28 GeV proton synchrotron, assigning the experiments to the items in the physics list of Professor Van Hove. We mention here some of the important changes in the arrangements for beams in the experimental halls and some of the forthcoming experiments.

An important new development at the PS is that a slow ejected proton beam-line (called es) from straight-section 62 is nearing completion. This beam-line is being built in the southern half of the East Experimental Hall where the CERN/Munich experiment (using beam-line d22a) on the electromagnetic decays of resonances into muons came to an end in the first week of December. The new slow ejected proton beam will provide long bursts of particles (hundreds of milliseconds) such as are required by electronic counter experiments. It will be guided to targets in the East Hall and several secondary particle beams can then be drawn from the targets. In addition to the increase in the number of available secondary beams, the beams will have high intensities enabling experiments to be completed quicker. Both these factors will serve to meet the increasing demand for counter experiments which has been one of the most significant developments in the PS experimental programme over the last two years.

Two experiments are scheduled to begin using es early in the new year. The first is an Aachen/CERN collaboration to gain further information about the interference of K° long-lived and K° short-lived mesons decaying into two charged pions (see, for example, CERN COURIER, October 1966, p. 195). In the new experiment, which will begin in the third week of January, the interference will be examined close to the target producing the K mesons. The second experiment will use, initially, an intense pion beam, with energies up to 20 GeV, to study the elastic scattering at wide angles (large momentum transfer) of pions on protons in a hydrogen target. A further high energy, high intensity pion beam will be built to use es from July 1967.

In the northern half of the East Hall an additional beam-line (k8) to the 2 metre hydrogen bubble chamber is to be constructed for the end of 1967. It will provide low energy (1-2 GeV/c) K meson beams. It joins m6 (which has electrostatic particle separators and provides K meson beams of 2-4 GeV/c, pion beams of over 1 GeV/c and anti-proton beams up to 5 GeV/c), and m8 (which has radio-frequency particle separators and can provide K meson beams up to 10 GeV/c) as the available beams for the hydrogen chamber. After Easter 1967, an additional r.f. separator will be added to the m8 line (which will then be called m10) to give beams of K mesons and pions up to 14.5 GeV/c and anti-protons up to 17 GeV/c. All these beams are derived from the ejected proton beam es.

The usual steady flow of collaboration experiments involving many European universities continues on the bubble chambers at CERN. Two which begin early in the new year use the m8 beam and the 2 metre hydrogen bubble chamber. A Hamburg/Padua/Pisa experiment is scheduled to take 100 000 pictures with anti-protons of 12 GeV/c; an Aachen / Berlin / Bonn / CERN / Krakow / Warsaw experiment also has 100 000 pictures with negative pions at 16 GeV/c. The 2 metre chamber will stop operation mid-February and will then be prepared for experiments, scheduled for the summer, using deuterium as the chamber liquid.

Also among the coming bubble chamber experiments is the neutrino experiment, using the CERN heavy liquid bubble chamber, which was described in last month’s CERN COURIER, together with its related counter experiment on muon conservation. These experiments are scheduled for March 1967 but already the fast ejected proton beam which produces the ‘neutrino parents’ is being used to test beam-line components.

When the neutrino experiment is completed in the autumn of 1967, the heavy liquid chamber will be moved to a new area which is being built behind the 2 metre hydrogen bubble chamber building. It will be used there for an experiment with high energy K mesons, which have passed through the 2 metre chamber. The interactions of these
Pions in medicine

The article on 'Elementary Particles in the Service of Man' in the October issue of CERN COURIER indicated that not many of the recently identified particles show promise of practical use at present. An exception is the negative pion. Beams of these particles may become useful for treatment of deep-seated inoperable tumours and some research on this possibility has been done at CERN.

The advantages of pions for the destruction of malignant tissue lie in the nature of their interaction with matter. First, the negative pions are most likely to interact at the end of their penetration paths and therefore, if their energy is carefully selected, they can pass harmlessly through healthy tissue to the region of the tumour. There, at the end of their range, they are 'captured' by nuclei and interact with nuclear matter emitting a high proportion of short-range heavily ionizing protons, alpha-particles and nuclear fragments. Since such reactions are particularly dominant in elements such as oxygen, carbon and nitrogen — the main components of tissue — a beam of negative pions offers a way of producing heavily ionizing radiation, highly localized in tissue.

Furthermore, it has been shown that tumour cells often suffer from a lack of dissolved oxygen, and this makes certain tumours resistant to X-rays and γ-rays which are the most commonly used for therapy. This resistance does not occur for heavily ionizing radiation like that created at the end of the range of negative pions.

No experimental work in treating malignant tumours with negative pions has been done yet. The pion beams available at present are too low in intensity for this purpose. For example, the beams from the CERN synchro-cyclotron would have to be increased in intensity by a factor of more than 100 to be of any practical use. In spite of this, several useful investigations of the feasibility of pion beams for therapy have already been carried out by the Health Physics Group at CERN. These investigations have covered depth and isodose distribution of a 70 MeV negative pion beam absorbed in water, average ionization densities at various penetration depths, and a study of the radiation doses from the nuclear reactions at the end of the pion range. This last problem is also of considerable interest for the radiation-protection of people using high-energy accelerators.

The results obtained so far look promising and are inspiring more experimental work, including tests using biological materials.

Computers

The CDC 6600 computer has been running steadily and the performance in recent weeks has been somewhat improved. Luciole and HPD I, the two types of automatic measuring machine for bubble chamber and optical spark chamber photographs, have been running successfully in parallel connected to the computer. The smaller CDC 3800 computer has been running very well almost continuously.

The organization of the users of the CDC 6600 series (VIM) held its fifth meeting in Dallas, USA in October. Most users appear to be well satisfied with the performance of the 6600, and many of them are planning to extend their computing facilities based on this computer. For example, the Brookhaven Laboratory is planning a system involving two 6600s connected to an extended core store.

CDC have agreed to extend the time for which CERN has an option on a 6400 computer until 15 January 1967. If the 6400 meets CERN's requirements on reliability it may be brought in as CERN's secondary computer with the advantage that it is fully compatible with the existing 6600. The 3800 will stay longer at CERN, certainly until well into 1967.
New appointments

At the 33rd Session of the CERN Council on 15 December some major new appointments were made to senior positions in the organization of CERN, to take effect from the beginning of 1967. The most important of them was the election of Dr. G. Funke (Sweden) to be President of the Council in succession to Mr. J. H. Bannier (Netherlands) who has been President for the past three years and is therefore not eligible for re-election. Mr. Bannier has led the Council with great distinction and at this, his final session in the Chair, he presented his proposals in connection with the programme of work on the proposed 300 GeV accelerator which, by themselves, would earn him the admiration and gratitude of the community of European physicists. Both the Council and the Director General recorded their appreciation of his work and a fuller and more fitting tribute will be paid in the next issue of CERN COURIER.

Dr. Gösta Funke is no stranger to CERN since he has represented Sweden as delegate to the Council since the beginning of the Organization and has served as President of the Finance Committee. He is also active in other international organizations being President of the Council of ESO (European Southern Observatory) which is building a large European observatory in Chile. Dr. Funke lives in Stockholm where he was born in 1906. He studied physics there at the University and obtained his doctorate for research on the spectrum of acetylene. He then taught at the Technical College of Norrköping. In 1945, he moved into scientific administration becoming Secretary General of two research Councils in Sweden – the National Council for Scientific Research and the Council for Atomic Research. CERN has therefore an experienced and well qualified successor to follow Mr. Bannier.

H.E. Mr. J. Giusti del Giardino, from Italy, and Mr. J. Martin, from France, were elected as Vice Presidents of the Council in succession to Dr. Funke and Sir Harry Melville (U.K.).

Finally the Council approved the appointment of Mr. H. Laporte (France) as Head of the Technical Services and Buildings Division.

While on the subject of new appointments, we forward our congratulations to M. André Chavanne, who leads the Swiss delegation to the CERN Council, on his election to the Presidency of the Conseil d’Etat of Geneva from 1 December.

Advanced training course

At a small ceremony organized at CERN on 8 December, 32 crane drivers and car drivers working at CERN, received certificates at the end of an advanced training course which they had followed in 1965 and 1966. Several senior staff members of CERN and of the Ecole Supérieure Technique, Geneva attended the ceremony including E. Leimgruber, Director of the Cours spéciaux du Bâtiment from the Geneva Cours Industriels du Soir, P. Tirion, ad interim Head of the Technical Services and Buildings Division, G. Vanderhaeghe, Head of the Training and Education Section at CERN, G. Leskens, representing the Safety Section, J. Mattheuws, representing the Personnel Division and other lecturers from the Cours Industriels du Soir and from CERN.

This course was organized jointly by the Training and Education Section and the Geneva Cours Industriels du Soir. It has provided the CERN drivers with 44 hours of theoretical and practical advanced training. They took three examinations to achieve their certificates.
The course was designed to enable the crane drivers and car drivers to acquire, by a varied course of daily practice, an increased familiarity with all the situations they are likely to meet in their work. Its aim was to complete their training, for most of them by practical experience, and to enable them to acquire systematically the knowledge which will help them to meet the requirements of their increasing work at CERN, especially in their site work and in the manipulation of their vehicles.

KN bumps

In the October issue (p. 196) we reported an experiment done by the Goldhaber group at Berkeley which analysed bubble chamber photographs of positive kaons on hydrogen. Their results indicated that the apparent resonance seen in the positive kaon-proton cross-section in an earlier Brookhaven experiment using electronic counters, could be explained, at least for the most part, as being due to production of other particles — an inelastic effect as opposed to a true resonance. This was comforting since the positive kaon-proton and positive kaon-neutron ‘resonance’, also observed in the Brookhaven experiment, would require an underlying model which uses more than three quarks. We reported at that time that there was insufficient data on the positive kaon-neutron system to explain away that ‘resonance’ in a similar way.

Results from a CERN experiment were reported at the Berkeley Conference which included information on this problem. They have since appeared as a letter in Nuovo Cimento.

Colloquia

Two colloquia will be held at CERN in January. At the first, on Tuesday 24 January, the speaker is Professor J. Volger from Philips, Eindhoven and the subject of his talk is ‘Induction Phenomena in Superconductors’. Some previous knowledge of physics will be assumed in this talk. At the second, on Thursday 26 January, the speaker will be Professor E. Gatti from the Istituto di Fisica, Milano.

Tribute to Dr. Schoch

It was announced on 21 November that Dr. Arnold Schoch, Leader of the Accelerator Research Division is to leave CERN to take up an appointment as Professor at Karlsruhe. At the end of the 33rd Session of the CERN Council, the President, Mr. J. H. Bannier paid particular tribute to Dr. Schoch and expressed the gratitude of CERN for his work, especially for

The tuning-capacitor assembly of the r.f. cavity for the intersecting storage rings. It consists of 23 vacuum capacitors, 22 ferrite rings and 2 vacuum relays all positioned around the metal-ceramic vacuum seal that forms the accelerating gap.
the important contribution he has made to the study of future accelerators.

Dr. Schoch arrived at CERN in 1954 from the University of Heidelberg. After some years in the Proton Synchrotron Division he became the first Leader of the Accelerator Research Division when it was formed in 1961 from the accelerator research group of the Proton Synchrotron Division. For the past six years, the AR Division has been mainly concerned with the next generation of accelerators. It produced the first design studies for the intersecting storage rings now being built at CERN and also for the proposed European 300 GeV accelerator, did the preliminary work on the radio-frequency separators, operated the electron storage ring model, CESAR and carried out other ‘general studies’ in accelerator physics. It has been unique in CERN in having three Division Leaders, K. Johnsen, A. Schoch and C. J. Zilver-schoon, who jointly assumed responsibility for policy decision and in turn assumed the administrative responsibilities of Division Leader for one year at a time.

When the ISR project was approved by the CERN Council at the end of 1965 the ISR Division (now the ISR Construction Department) was set up under Dr. Johnsen with Dr. Zilver-schoon as Deputy Division Leader, to take charge of the project. Most of the people involved in the preliminary ISR work had also concerned themselves with the 300 GeV project and it was therefore logical to include the continuing work on the 300 GeV machine also under the ISR Department. Thus the activity of the AR Division was substantially reduced.

Following Dr. Schoch’s departure the remaining activities of the AR Division are to be transferred to the Intersecting Storage Rings Construction Department. The work will be divided into two groups within the ISR Department. One, under M. Pentz, will continue research with CESAR until the end of 1967, when it is planned to close down the model. The other group will be under F. Schneider concerned with general studies.

We forward our very best wishes to Dr. Schoch for his future career and echo the tribute of Mr. Bannier for the part he has played in some of the most important work emerging from CERN in recent years.