

PARTICIPANTS

Delegates from 13 member States of CERN met at Meyrin on 8 and 9 December 1960 for the 18th Session of CERN Council, the supreme body which takes all important decisions concerning the life of the Organization.

Mr. F. de Rose, representative of France, presided over the discussions in which the following delegates took part :

Austria :

Prof. W. Thirring
Prof. F. Regler
Dr. E. Treu
Mr. E.M. Schmid*

Belgium :

Mr. J. Willems
Prof. J. Franeau

Denmark :

Prof. J.K. Bøggild
Mr. O. Obling

the Federal Republic of Germany :

Prof. W. Heisenberg
Dr. A. Hocker
Prof. W. Gentner*
Prof. W. Jentschke*

France :

Prof. F. Perrin
Mr. F. Neumann

Greece :

Prof. T. G. Kouyoumzelis
Mr. J. Tsambiras
Mr. P. Economou*

Italy :

Mr. G.B. Toffolo
Prof. E. Amaldi
Dr. C. Albertario*
Dr. C.C. Bertoni*
Dr. L. Ottieri*

the Netherlands :

Mr. J.H. Bannier
Prof. J. de Boer
Mr. C.E.I.M. Hoogeweegen*
Prof. S.A. Wouthuysen*

Norway :

Mr. S.C. Sommerfelt
Prof. H. Wergeland
Mr. M. Huslid*

Sweden :

Dr. G. Funke
Prof. I. Waller

Switzerland :

Prof. P. Scherrer
Mr. A. de Senarclens
Mr. S. Campiche*
Mr. R. Bieri*

the United Kingdom

Sir John Cockcroft
Dr. T.G. Pickavance**
Mr. H.L. Verry**
Mr. G. Hubbard*

Yugoslavia :

Mr. D. Baum
Dr. A. Moljk
Mr. B. Komatina*

Spain (as observers) :

Mr. J.-M. Aniel-Quiroga
Mr. C. Sanchez del Rio
Mr. P. Temboury

* Advisers

** Alternates

CERN in

In February 1960, the CERN proton synchrotron was inaugurated with all the dignity appropriate to such an important occasion in the life of the CERN laboratory. Amongst the hundreds of guests were four Ministers : Prof. Balke, Minister of Atomic Energy of the German Federal Republic ; Mr. Cals, Minister of Education, Arts and Sciences of the Netherlands ; Lord Hailsham, Minister for Science of the United Kingdom and Mr. Medici, Minister of Education of Italy. The world of science was represented by Professors Niels Bohr, Francis Perrin, Edoardo Amaldi, Sir John Cockcroft, Edwin McMillan, J. Robert Oppenheimer, W. Heisenberg, P.M.S. Blackett and many more. The presence of over one hundred press correspondents showed the interest aroused by this ceremony all over the world. The speeches of Mr. de Rose, the President of the CERN Council, Prof. Amaldi, the Chairman of the Scientific Policy Committee, Prof. McMillan and Oppenheimer, were replied to by Professor C.J. Bakker, Director-General of CERN, on behalf of the staff of the whole laboratory.

Two months later, on 23 April, Prof. Bakker was killed in an aircraft accident whilst visiting the USA. From jubilation and celebration over the success of the proton synchrotron, the laboratory of CERN was plunged into mourning for its Director-General. The tragedy is now past but the period of recovery is only just coming to an end.

For the staff of CERN, the death of Prof. Bakker, the uncertainties about the new Director-General, the internal reorganization of the laboratory, have together produced, quite unavoidably, feelings of anxiety and unrest.

Despite these sad events and greatly to the credit of the staff of the laboratory, to their morale and their loyalty to CERN, the work has

The following article is made up of large extracts from the introduction to the Divisional directors' progress reports presented by the Director-General, Dr. J. B. Adams, at the beginning of the 18th Session of the CERN Council. The photographs on page 15 illustrate the progress of CERN during 1960. From top to bottom: the installation of part of the 4000 km of cables which run underneath the PS ; the piping for evacuating propane behind the South experimental hall

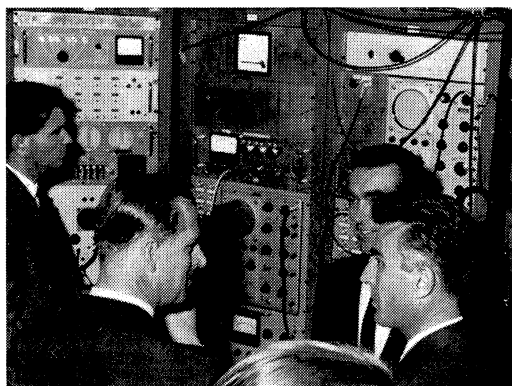
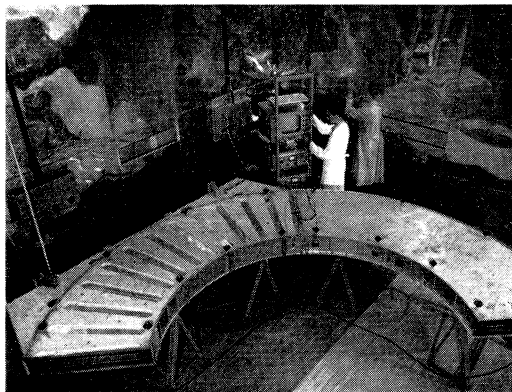
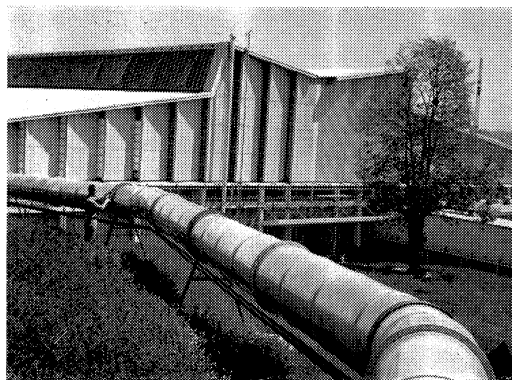
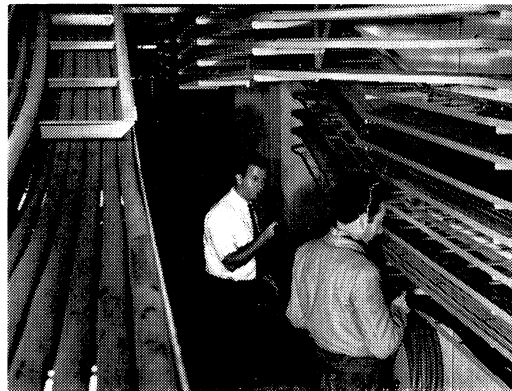
gone on, not just satisfactorily, but at a tempo that has gained for CERN a place in the forefront of the great high energy physics laboratories of the world.

The laboratory at Meyrin attracts many visitors who come to see the installations and the work going on. During the year 1960, 3249 visitors came to the site. The visit of H.R.H. the Duke of Edinburgh was a most memorable one for all the staff of the laboratory.

It is my task, as the present Director-General, to give the Council an impression of what the laboratory has achieved this year. Detailed reports from the Directors of the Divisions of CERN have been written down and will be commented upon later by the Directors. My task would be incomplete without reference to the future, for part of the current work of a laboratory is future planning.

The synchro-cyclotron

the first of our two accelerating machines to come into use as a nuclear tool, has been used so far for two purposes. The first was as a training ground for experimental teams which this year have been carrying out the exploratory nuclear physics work with the proton synchrotron. For the majority of the staff of these teams, the synchro-cyclotron experiments have been their first experience in high energy physics research. That we have been able this year to switch competent teams over to the experimental work with the big machine has been due mainly to the excellent training and experience they gained with the smaller machine. The second purpose of the synchro-cyclotron was to carry out fundamental research in pion and muon physics. Such experiments as the "pion-elec-



of the synchrotron ; part of the new accelerator research equipment ; a picture taken during the visit of the Duke of Edinburgh in April. On page 18, from left to right : the PS inauguration in February 1960, survey work in preparation for the development of the East experimental area of the PS and finally, the new muon channel of the synchro-cyclotron.

tron" decay and the current measurement of the anomalous magnetic moment of the muon, the so-called "g-2" experiment, are, perhaps, the best examples of such work. With the success of the new muon channel this year, the future experimental programme will centre more around muon physics.

However, the synchro-cyclotron is not a unique machine, there are many others in the world, and now that new physicists can join experienced teams on the large machine, we should consider the future of the smaller one. An increase of one or two orders of magnitude in the beam intensity would open up a new field of research in pion and muon physics and put CERN in the forefront of this field. The only attempt made so far in this direction at CERN has been the trials of the stochastic method of acceleration using non-coherent acceleration to overcome the space charge limitations in coherent acceleration near injection. Although this method showed promise at the beginning, the recent trials have only doubled the beam intensity. A much more fundamental modification that could be made to the synchro-cyclotron would be to convert it to a spiral ridge cyclotron operating with a continuous output instead of the present pulsed one. Such modifications have been studied by groups outside CERN and spiral ridge beam dynamics have formed part of the studies of the Accelerator Research Division of CERN. It is our intention next year to work out a project for modifying the cyclotron to a spiral ridge machine and if this looks feasible and promising we will be asking the Council, sometime in 1962, if not earlier, for an extension to the present programme of CERN to carry out such a project. The present budget and staff ceiling of CERN will not be sufficient to cover such a major modification.

The proton synchrotron

which came into operation for the first time at the end of 1959, has been operated throughout the whole of 1960, and more time has become available for nuclear physics experiments as the year proceeded. A steady improvement in beam intensity was achieved in the first six months and starting with 2.10^{10} protons/pulse at the beginning of the year, the intensity was raised to 3.10^{11} protons/pulse by the summer months. The present mean intensity of 10^{11} protons/sec is the highest of any proton synchrotron so far built and the maximum energy of 25-28 GeV can only be exceeded by one other machine in the

world, the Brookhaven 30 GeV AGS which came into operation in the autumn of this year.

Although the time available for nuclear physics experiments this year has been relatively modest: 95 hours in the first quarter, 180 hours in the second, 300 hours in the third and 600 hours planned in the fourth, good use has been made of the remaining operating time to develop target techniques which enable more than one experiment to be run simultaneously, thus doubling or tripling the effective experiment hours. Targets giving short bursts of secondary particles of 200 to 300 microseconds duration

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and low intensity, for bubble chamber experiments, can be used at the same time as other targets giving long bursts of high intensity of up to 400 milliseconds for counter experiments. This sharing of the accelerated beam between several experiments will be even more extensively used when the North experimental area becomes available.

The South experimental area, the only one available in 1960, which looked so large when it was empty at the beginning of the year, is now packed with experimental equipment. Three bubble chambers, two operational and one in course of construction, occupy the end of the hall in a region that has been modified to be safe for hydrogen and propane use. Liquid hydrogen targets are placed in specially designed houses on the floor of the hall and, together with the bubble chambers and a high pressure ethylene Cerenkov counter, form a remarkably explosive ensemble in one large hall. The safety precautions taken to prevent accidents are stringent and so far effective. Plans for new laboratories, a new workshop, a new apparatus assembly hall and the East experimental area will steadily make available more and more space for experiments with the proton synchrotron, in 1961 and 1962.

At the beginning of the year very few bending and focusing magnets were available for the experiments but by September most of those ordered in 1959 were delivered and 10 megawatts

of d.c. power was available from 30 generators to power these magnets and those of the track chambers. Although no particle separator has been in operation this year, a large electrostatic separator should be ready in mid-1961 capable of going up to 6 GeV/c momentum and a project for a radio-frequency separator for 10-15 GeV/c momentum has been started this year. Meanwhile a relatively small electrostatic separator has been offered by an Italian group and will be installed in February 1961.

Over 100 000 photographs

have been taken this year in the high energy

1960

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pion and proton beams of the PS using two chambers, the 32 cm CERN hydrogen bubble chamber and the 1 m Ecole Polytechnique propane bubble chamber. Early in 1961 it is hoped to replace the 32 cm CERN chamber by the 81 cm C.E.A. hydrogen bubble chamber and towards the end of the year the 1.5 m UK hydrogen bubble chamber should be installed in a special building in the East experimental area. Also the 1 m CERN propane chamber should be operating very early next year and a helium bubble chamber is coming to the laboratory from Rome.

Photographs are but the first necessary step in the complicated process of achieving nuclear physics results using bubble chambers. The analysis of these photographs needs further specialized machines and computers. This year three analysing machines, called IEP, have been in operation and the data from these machines have been fed into the Mercury computer. In early November a much larger and faster computer, the 709, was delivered to the site and next year seven analysing machines should be in operation at CERN using the 709 for data processing.

Even these facilities for bubble chamber photograph analysis will not be able to cope with all of the pictures produced by the chambers at CERN, and all over Europe laboratories are setting up similar analysing facilities. This year the photographs have been analysed by teams

in Italy, Germany, France and the UK, as well as by the CERN teams.

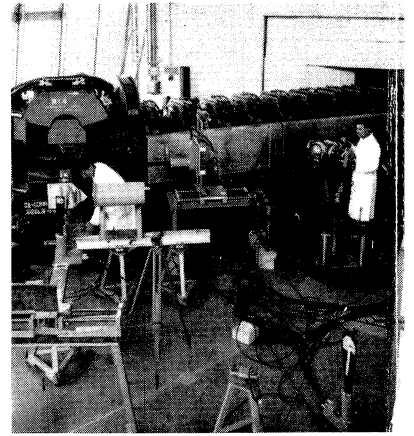
Experiments using techniques other than bubble chambers, counter experiments and emulsion experiments, have been energetically pursued and although in general all experiments have been exploratory and preparatory for later more comprehensive ones, some remarkable results have been obtained. The presence of high energy deuterons, tritons and helium 3 nuclei in the secondary beams of the PS was perhaps the most interesting. The abundance of anti-protons and K particles in the secondary beams from internal targets is also to be noted.

In the second part of this year a great deal of interest has been aroused in the possibility of carrying out neutrino experiments using the high energy particles from the PS. It now looks feasible to set up an experiment, on rather a large scale, to determine whether or not there are two types of neutrinos. This work may well open up a new field of high energy physics.

Theoretical studies

both for the experimental programme and to improve fundamental understanding of the nature of the nucleus, have continued this year. Theoreticians working at CERN have the unique opportunity of being in the midst of very active and exciting experimental work in a new energy range, and the number of young fellows and experienced visitors wanting to participate in these studies bears witness to the interest aroused. Although the total number of CERN staff in the Theoretical Division is only nine, the average population including visitors and fellows has been about forty during the year. Next year the number of CERN staff will be increased to twelve, to give a better balance between staff and visitors.

The problem of the utilization of the two accelerating machines of CERN and the experimental facilities of the laboratory by European physicists from outside CERN has received considerable study this year. CERN has on its staff experimental physicists and theoreticians but working at the laboratory are a large number of non-CERN staff scientists, some paid by CERN through fellowships and some paid by the European laboratories and institutes using their own funds. In 1960, the average numbers of



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scientists in the various categories were as follows :

	Experimental physics	Theoretical physics
CERN staff (engaged on research programmes) .	60	9
CERN fellows & research associates (paid by CERN funds)	23	25
Ford fellows (paid by Ford Foundation through CERN)	10	5
Visiting scientists (not paid by CERN)	50	0
Total	143	39

All these scientists use the facilities of the CERN laboratory, the administrative services, the technical facilities and the beams of particles from the accelerating machines. They all have to be found space to work on the site and in some cases space has to be found for the apparatus they bring with them. The total represents the scientific effort of the laboratory, and to make this effort effective there must be adequate technical assistance. Outside CERN, but still using the facilities of the laboratory, are the teams in the universities who, in general, do not work at CERN, but who depend on work done at the laboratory, such as the emulsion teams analysing the plates exposed to the particle beams of the proton synchrotron and the teams analysing the bubble chamber photographs. CERN provides interesting fundamental

research work for all these scientists. It is a wonder that the utilization of the laboratory, the choice of experiments and the participation in the research work should raise problems that are not easy to solve to everybody's satisfaction.

During the course of this year, a new system of arranging the research work of the laboratory has been worked out that brings in the external research teams in a more definite manner which we hope will go a long way to solving this problem. Underlying this new system is the idea that distinctions between CERN staff, fellows and visitors should be minimized by the formation of research teams containing all such physicists in proportions appropriate to the experiments being done and the apparatus being used. This system is already working very well with the PS experiments.

The CERN proton synchrotron is an exceptional machine and should be used by the benefit of our European physicists. However, there are other machines in Europe and many of our best physicists are committed to use them in addition to their teaching duties at our universities. Some way must be found to allow these people to participate more freely in the research work at CERN and this may involve modifications to the staffing ideas of the universities. It seems that more senior posts are needed at the universities so that the teaching work can be done while part of the staff are on leave of absence, at CERN, for reasonably long periods. As can be seen from the figures given, CERN already pays for over 60 fellows and research associates and within the present budget no more places can be made available. Furthermore, the amount of technical assistance available for research physicists at CERN is rather small. Therefore, even

effort should be made by the responsible authorities in our Member States to send their best physicists to CERN together with their technicians, and to find national funds to support them in their work. Alternatively, some way must be found for CERN to pay them.

The future of the laboratory

I would like to conclude with some remarks about the future of the laboratory. CERN has been extraordinarily successful. This laboratory has been created from the beginning due to the efforts of the members of the Council, to the support we have received from our member States and very much to the devotion of the staff of our laboratory. We now have two machines in operation and by 1962 the laboratory will be equipped with a vast amount of experimental apparatus to carry out fundamental research in high energy physics. The short term future is obvious enough. We must carry out research of a quality that will justify the fine equipment that we all have worked so hard to build. It is the long term future that concerns me now. The laboratory of CERN as you see it today is the result of plans formulated in 1950. We should now in 1960 be making plans for 1970. I have already mentioned our ideas for modifying the synchro-cyclotron to make it into a far more interesting machine in the future from the nuclear physics point of view. We have also been considering plans for modifying the proton synchrotron.

In the Accelerator Research Division, a group is already at work building an electron model of a storage ring system that, if it is successful, could be applied to the PS. A study is being made of what such a modification would mean to the PS, and the preliminary ideas involve a

project whose cost might be as much as twice that of the PS machine itself. By 1963, if the results of the electron model studies are satisfactory, we might be in a position to begin such a project and by 1970 it could be finished. By this means CERN in 1970 would be in possession of another nuclear physics tool that would be unique in the world, allowing experiments to be done with energies in the centre of mass system of 50 GeV. If we do nothing now, Europe in 1970 will again be in third place, with the Americans having a 100 or 300 GeV proton accelerator and a 30 GeV electron linac and the Russians a 70 GeV proton synchrotron and perhaps even higher energy machines. Quite apart from accelerator development, there is the development of experimental apparatus. In 1963, we should have the 2 m hydrogen bubble chamber in operation but this is hardly bigger than the one that has been operating in Berkeley for several years. Also we are planning new analysing machines for the bubble chamber photographs which, if they are successful, will lead to new and costly projects and this by no means exhausts the possibilities.

There are in fact **two ways for CERN to go in the future** : **either** it settles down with a fixed budget and a fixed staff complement to use the facilities it has now planned, which will mainly be available in 1962, adding from time to time such new experimental apparatus as can be afforded within the budget limits and built by the staff available, **or** it can decide to remain in the forefront of high energy nuclear physics adding to the programme of the laboratory such machines, modifications and apparatus as will maintain the laboratory in its present unique position. This second course is inconsistent with the notion of permanently fixed budgets and staff complements ●