NINTH SESSION OF COUNCIL
Geneva - 19 December, 1957

PROGRESS REPORTS
OF THE DIRECTOR-GENERAL AND DIVISIONAL DIRECTORS
PROGRESS REPORT OF THE DIRECTOR-GENERAL
AND DIVISIONAL DIRECTORS

INTRODUCTION
by the Director-General

During the period under review construction work on both accelerators and on the buildings at the CERN Site at Meyrin has progressed according to schedule. At the end of November 1957 practically the whole staff was installed on the Site, so that cooperation between the various Divisions and the co-ordination of their work have been greatly facilitated.

On 1 August 1957, the CERN 600 MeV Synchro-cyclotron came into operation practically on the date foreseen many years ago. This fact has undoubtedly given rise to a new atmosphere in the Organization, because the phase has now started when CERN scientists and visiting scientists from Member States can actually perform experimental research with a CERN machine.

An interesting programme of research will now be carried out, in which Professor Bernardini, who was recently appointed Director of Research in the SC Division, is taking an active and leading part.

The assistance, which the Theoretical Division is always ready to give to the experimental physicists, is of utmost importance. In this respect CERN might well be unique in the world as an example of extremely fruitful co-operation between experimental and theoretical physicists.

The Proton Synchrotron Division will also enter a new phase soon, as after many years of preparation the actual assembly of the accelerator components will start early next year. Work progresses according to schedule and the machine can be expected to come into operation in 1960 as planned, provided that no unforeseen difficulties arise in the next few years.

Preliminary work has been started on the preparation of a research programme for the CERN 25 GeV Proton Synchrotron. The Theoretical Division prepared a draft programme, which was also discussed in wider circles at the international conference in Venice-Padua, in September. A research group is now being established in
CERN in order to study the programme in detail and it will first be engaged on the design and construction of the heavy experimental equipment, required for research with the machine. Such equipment may take many years to construct and it should be available by the time the machine is finished in order not to delay the starting of research work. Detection methods also have to be studied carefully. This research group will have its headquarters near the Proton Synchrotron, but it is considered essential that it should work in close co-operation with the experimental physicists in the SC and the STS Divisions, with the applied physicists in the FS Division and with the Theoretical Division. The group will be using the Synchro-cyclotron to test apparatus and eventually to do some research. A joint effort of CERN should thus make it possible to evolve the best method of using the Proton Synchrotron for fundamental research in physics.

In the Scientific and Technical Services Division, the rapid development of bubble chambers and of methods for the instrumental evaluation of track chamber pictures might be mentioned in this introduction as being of great value for experimental work with the machines.

Detailed information on the progress of the work in the Divisions is to be found in the reports of the Divisional Directors.

From 1 October 1957, theoretical studies were concentrated at CERN in Geneva, and the Theoretical Division in Copenhagen thus terminated its work. Detailed descriptions of all the important work accomplished by the Copenhagen Division were given in preceding progress reports. It is fitting to record here our gratitude to this Division, which initially under the leadership of Professor Niels Bohr, and later under Professor Møller has played a considerable part in establishing CERN's good name all over the world.

During August 1957, a first meeting was held of the Advisory Committee to the Director-General on the use of the Synchrocyclotron by visiting teams from Member States. Such co-operation is considered to be of great importance to both the Member States and CERN.

Several first class physicists from non member states are now pursuing their studies in the CERN Laboratories through the grants offered by the Ford Foundation. This certainly adds considerably to the general standard of physics research and is of great benefit to the Organization.

Preparations are being made for the Eighth Annual Conference on High Energy Nuclear Research in Geneva as a continuation of similar famous international conferences held for 7 years in succession at the University of Rochester, Rochester (N.Y.) USA. Invitations to the CERN Conference will be sent out shortly.
Budget difficulties arose in the latter part of 1957 owing to CERN's increasing need for financial support to pursue its programme and to the difficulties many Member States encounter at the moment to commit themselves to providing the sums requested. An extraordinary Council session in November 1957 discussed the problem and it is hoped that at the December Session of the Council, measures can be taken to meet fully CERN's well recognized needs.

The Director-General represented CERN in September 1957, at an international conference at the Weizmann Institute, Rehovoth, Israel, which he had been invited to attend by the organizers.

Several CERN physicists including the Director-General took part in the international conference on Mesons and Recently Discovered Particles, in Venice-Padua, in September 1957.

PUBLIC INFORMATION OFFICE

1. Press, radio, television

During the second half of 1957 the Public Information Office continued its co-operation with the world press and other information media, and laid plans for more systematic dissemination of news about CERN.

Facilities were given to reporters from Member and non-Member States for on-the-spot news, feature, radio and television coverage of CERN activities. On the visual information side, assistance was given to photo and newsreel reporters.

Nearly all articles written by visiting reporters were submitted to the Public Information Office for checking in advance of printing.

A well attended press conference and reception was arranged in connection with the summer Council Session.

In accordance with a new policy to issue press releases only in connection with important events of spot news interest, only one release was made in the period. This release, announcing the successful completion of the Cyclotron, received an astounding circulation, nearly 250 newspaper clippings having been logged to date.

An analysis undertaken of all press clippings received through the medium of Argus since the start of the information services, showed that about 450 newspapers in all parts of the world regularly show interest in CERN activities. The analysis did, however, show up important geographical areas with weak coverage of CERN, and the information gained by this study will be used to plug the gaps early in 1958.
Plans were prepared for a CERN feature service, giving in the form of a newsletter every second month news about CERN activities, popular information about nuclear science and news about CERN personalities and visiting scientists. The newsletter, which is designed to ensure more regular dissemination of information about CERN, will be distributed to all interested newspapers and magazines.

The Public Information Office is also studying a suggestion to compile an internal newsletter to be issued every fortnight to keep CERN staff informed of activities in the different Divisions.

2. Exhibitions

The Public Information Office arranged for the participation of CERN in the international exhibition "Het Atoom" at Schiphol, near Amsterdam, with a stand including models of the Site, the two accelerating machines, the Proton Synchrotron magnet blocks and a large aerial view of the Site. The opening of the exhibition was attended by the Public Information Officer together with the Scientific Information Officer.

The Public Information Officer was invited to take part in the final session of the working committee preparing the World Exposition at Brussels, 1958. CERN is scheduled to take part in the nuclear science section of the Science Hall with models of the accelerators and possibly other material.

Authorization was given to the CERN firm of architects to show a model of the Site at the exhibition "Die unbekannte Gegenwart" at the Globus in Zürich.

3. Visits

During the period the Public Information Office gave facilities for 236 visits with a total of 2227 participants. The visitors came from 37 countries and territories in all parts of the world.

Determined efforts were made to regulate the influx of visitors as the Public Information Office is not equipped to take care of everybody who wants to see CERN. Preference was given to visitors in the political, scientific and technical categories, while several "tourist" groups - mainly from Switzerland - had to be turned away.

4. Miscellaneous

The Public Information Office assisted leading CERN scientists in preparing articles about the organization for publishing.
Assistance was given to CERN staff in the preparation of general lectures on CERN. In addition, lectures to local associations were given by Mr. J.R. MacCabe of the Information Office.

Incoming information in the form of press clippings, news releases and bulletins as well as information gleaned from other sources was disseminated among the appropriate CERN staff.

COSMIC-RAY EXPERIMENTS

1. The Geneva Multi-Plate Cloud Chambers

It was decided in October that the K-meson experiment being performed in Geneva should be stopped. The reasons for this decision can be summarised as follows:

1) the scientific interest of the results of the experiment had dwindled considerably since there is now good reason to think that all K-meson decays are decays of one type of particle with a unique mean lifetime,

2) revised estimates of the possible rate of observing K-meson decays suggested that it was extremely unlikely that an adequate rate could be obtained with the Geneva equipment, and

3) it was clear that considerable modifications would be required before the apparatus could achieve any significant number of observations.

The technical performance of the two multi-plate cloud chambers themselves is extremely good. It has been decided to prepare one for use with an accelerator so that, in the future, it will be available for any experiment for which it is suitable. This work has already been started with a reduced staff.

2. The Jungfraujoch Experiment

It has also been decided that the Jungfraujoch experiment shall draw to a close in the middle of 1958. The present study that is being made of high energy interactions will by then be completed and no further work at the Jungfraujoch is contemplated.

The results of the previous experiment on the production of V-particles in different materials have been analysed and submitted for publication.
3. Further Work

A proposal for a more ambitious experiment to study 100 GeV interactions was submitted by the Director-General to the Scientific Policy Committee in October. The SPC recommended that CERN should not undertake such an experiment but should consider supporting any national or bi-national initiative to perform the experiment.
PROGRESS REPORT

PROTON SYNCHROTRON DIVISION

(1 May, 1957 - 31 October, 1957)

by J.B. Adams

1. INTRODUCTION

The work of the PS Division has proceeded according to the programme without any serious set-back during the period under review.

The contract for the vacuum pumping equipment, which is the last major contract for a machine component (i.e. above 500,000 Sw. Frs.), will be placed before the end of the year. Other smaller contracts have yet to be placed in the following year. Many members of the Division are resident at the contractors' works, testing and approving the apparatus before it leaves the works and supervising the manufacture of the equipment.

The staff has increased from 148 (30 April, 1957) to 163 working on the design and construction of the PS, plus 9 Fellows in the Research Group studying new ways of accelerating particles (22 November, 1957).

The whole Division is now installed at Meyrin and the old offices and laboratories at the Institute of Physics in Geneva have been completely vacated.

2. ORBIT THEORY (A. Schoch and M.G.N. Hine)

a) General Problems

The electromechanical betatron oscillation analogue has been improved by two additions: (1) a direct display of the phase plane paths of one dimensional particle motion on an oscilloscope screen, (2) a pulse generator producing 20 adjustable kicks per revolution for the simulation of misaligned magnets. This device will be used for the study of procedures for straightening a distorted closed orbit.

Most of the experiments done earlier in order to check orbit perturbation theory have been repeated using the improved technique of display. The analogue was also used for the study of "beam stacking" in the CERN Synchro-cyclotron, a phase oscillation problem which could be satisfactorily simulated by the analogue and fitted in well with the study of dynamic traversal of resonances still under way.
The work on the new betatron oscillation analogue using a bunch of electromagnetically suspended electrons was mainly dependent on obtaining the high vacuum required. $10^{-9}$ mm Hg have now been reached. Under these conditions an electron would carry out more than $10^6$ oscillations per collision time, which makes this analogue feasible.

The problem of evaluation of pick-up electrode information on the shape of the beam in the PS is being studied theoretically.

b) Special Problems

Preparation of the big computing programme for orbits in the complete synchrotron has been held up because of serious delays in delivery of the CERN computer. A reduced programme for use on a machine outside CERN is being worked on.

The detailed performance specifications for lenses and pole-face windings have been worked out in collaboration with the Magnet Group, and problems likely to occur in connection with the magnet block testing programme have been studied.

Work has been started on procedures to be adopted during the running-in period of the synchrotron, so that adequate measuring and control equipment can be ready in time, and that the testing programme can be fixed.

3. RESEARCH ON NEW IDEAS FOR ACCELERATORS (A. Schoch)

In the preceding progress report the initiation of a group for research on new ideas for accelerators was reported. The first subject taken up by this group was the scheme of a plasma ring accelerator proposed by Budker at the Geneva Conference on High Energy Accelerators in 1956. In this scheme the magnetic field inside a high electron current thread forming a closed ring is used to guide particles which can be accelerated to high energies. The main advantage of this scheme over conventional accelerators lies in the possibility of obtaining stronger guide fields, and therefore smaller radii of curvature of the accelerated particles. The primary difficulty, which has to be overcome before such a scheme becomes a practical possibility, is the formation of a very thin high current plasma thread of extremely low density, having sufficient stability and lifetime to permit one acceleration cycle. Budker's proposal is based on the self-constriction of a high current electron beam whose space charge is partially compensated by positive ions. It seemed reasonable to form such a beam starting with a neutral plasma in a toroidal chamber situated in a betatron type field which is used to accelerate the electrons in the plasma and so produce the required circulating current.
Theoretical studies have been made on the conditions for obtaining continuous acceleration of electrons ("run-away" electrons) in a plasma (against friction due to collisions with ions), and on the mechanism of self-constriction, which is an oscillatory phenomenon in general.

Experimental studies have begun with an air-cored betatron, which has been designed and constructed complete with a condenser bank (about $10^2$ joules of stored energy) for powering it, and the necessary timing and triggering circuits. The toroidal chamber of the betatron (26 cm orbit radius) can be filled with hydrogen plasma produced by a gas discharge at one point on the circumference which spreads around the torus guided by a longitudinal magnetic field. The properties of this plasma are being measured at present and about $10^{10} - 10^{11}$ electrons per cm length of the toroidal chamber have been obtained. If all these electrons are accelerated to relativistic velocities, the resulting current would be 50 - 500 amps. A few devices for measuring the total plasma current and the electron energy have been prepared.

Various methods of ionizing hydrogen at very low densities have been tried, such as D.C. discharges in a Penning Gauge arrangement, hollow hot cathode discharges, and high frequency discharges where the diffusion is quenched by a high frequency electric quadrupole field. The last method looks interesting because it does not need magnetic fields.

Furthermore, the problem of stability of a pinched ring current against bending perturbations (kinks) has been studied theoretically. Concerning this problem many questions have yet to be answered, but it seems clear that a plasma ring current cannot be maintained without applying powerful stabilizing forces in addition to that due to the magnetic field shaping the ring.

It is expected that the experiments which are now underway will indicate the general utility of plasma ring discharges as accelerator guide fields.

As a second subject, the study of methods of "beam stacking" is being taken up.

4. **MAGNET (C.A. Ramm)**

   a) **Magnet Blocks**

   The steel store contained on 15 October, 1957, i.e. one month ahead of the contract date, some 4,030 tons of steel of excellent magnetic properties. We have been able to keep pace with our steel measurements, so that the second half of the steel store is finally arranged and ready for use. For all practical purposes the two halves of the store are identical and the overall situation concerning the magnetic properties is even better than was anticipated.
Manufacture of the closed type magnet blocks has commenced, and already the first production blocks have arrived at Meyrin and have been studied magnetically. It is too early to forecast reliably the trend of the production, but the situation is encouraging. Excellent production apparatus has been constructed and installed by the blockmaker, and there has been good co-operation in attacking the production problems. It is hoped to reach the maximum production rate shortly.

b) Coils and Other Major Components (C.J. Zilverschoon)

The magnet coils are in full production. About one hundred coils are ready and being tested in the factory. Eight coils were delivered to CERN, and representatives from the manufacturer made a trial installation in order to find out what auxiliary tools will be necessary. Continuous delivery will start this month, and it is hoped to start the installation sometime in February.

Delivery of the supporting girders, jacks, coil protections and many other items has started and a total of some 90,000 pieces for the magnet construction is already in stock in CERN.

The contract has been placed for the delivery and installation of the complete bus bar system by which the magnet coils will be connected in a series chain. These bus bars of aluminium will be water cooled and insulated in the same way as the magnet coils.

c) Measuring Programme

The block measuring machine functions satisfactorily and it is possible to detect significantly differences in the magnetic field gradient from one block to another of the order of a few parts in 10^5. Much effort has gone into the study of the best methods of operating the machine for the block measuring programme and a satisfactorily rapid procedure has been developed, so that we may confidently expect to keep the measuring programme abreast of the block production programme.

Parts of the unit measuring machine are already installed and it is expected to complete the mechanics of the machine by about the end of the year. The 7,000 amp unit connections have been completed.

Apparatus has been designed and constructed for the magnetic testing of the constructional materials of all items which may influence the magnetic field seen by the protons during their acceleration in the machine. In the case of the vacuum chamber sensitive production permeability and resistivity tests are in progress at the premises of the supplier of the stainless steel, and work has been completed on the coil covers.
d) **Poleface Windings and Magnetic Lenses**

Serious practical problems have been presented by the construction of the poleface windings. It is believed that these are now solved and a contract, based on satisfactory production samples, has been placed. Contracts for the quadrupole lenses and their power supplies have also been placed and tenders are being considered for the 1400 KW peak poleface winding power supply and for the sextupole and octupole lenses and power supplies.

Studies are in progress to develop electronic control systems to ensure that the excitation of these various correcting devices will be adequately automatic and reproducible. The basic methods of excitation to be used are based on systems that have been developed over the past three years and which are in successful operation on the 1100 KW peak power supply for unit testing and the smaller 500 KW peak power supply for the block measuring machine.

e) **Unit Assembly and Installation Problems**

Preparations are being made for the magnet unit assembly and installation programmed which will commence early next year. Assembly jigs have been manufactured and tested, and recent trials of handling apparatus for the 34 ton units have proved satisfactory. We are awaiting the magnet block delivery and the results of the magnetic measurements in order to determine the course of the unit assembly programme.

5. **RADIO FREQUENCY** (Ch. Schmelzer)

a) **Accelerating Units**

The pre-prototype of the accelerating units has been delivered to CERN by Marelli early in September and has undergone thorough tests. The overall performance of the unit was in general satisfactory. It was, however, necessary to make changes in the physical layout of the electronic parts, to improve screening and to adapt the controls to the PS system. The corresponding redesign has been carried out in close and efficient co-operation with Marelli.

A screened test-bay for acceptance tests of the accelerating units has been erected, and the complete installation of the test-bay will be finished by the end of January, 1958.

The delivery of the ferrite cores for the accelerating resonators goes according to schedule. 30 out of 38 cylinders have already been delivered by Philips to Marelli. Philips has been able to improve the quality of the ferrite over that of the test samples sent along with the tender, and the cores built into the pre-prototype showed a decrease of r.f. losses by nearly a factor of two over the values expected from the tender samples.
b) Hall Computer

The Mark II computer has been finished and undergone a very thorough test programme. The reproducibility over 8 hours without any readjustments is equal to about ± 0.5 parts per thousand at injection fields and better at higher fields. The computer reproduces the theoretical frequency v. field law within ± 3 parts per thousand. Considerable improvement of this accuracy is possible though not intended. Instead, means of arbitrarily modifying the programme within ± 2% have been developed, partly in order to take care of changes of effective magnet length during the accelerating cycle, partly for experimental purposes during the running-in time of the machine.

c) Programmed Generator

Effort was concentrated on the development of the servo-controlled generator as alternative to the spin generator, after preliminary experiments with a linear frequency-voltage converter, based on the measurement of charging current of a fixed capacitor, proved to be encouraging. A first servo oscillator was built and operated successfully, using a frequency-voltage converter with about ± 1 part per thousand linearity and a reproducibility over 8 hours of approximately one part per thousand.

d) Beam Control

Theoretical work has indicated the inherent stability of the phase-lock system proposed for the CERN machine under the circumstances outlined in the CERN Symposium 1956.

Experimental work on the design of transverse and phase pick-up electrodes is being carried out and a prototype for the pick-up electrode structure has been designed. In addition, wideband high gain amplifiers with small and stable phase shift have been built and successfully tested.

e) Phase Oscillation Analogue

The improved analogue has been used to measure the anisochronism of large amplitude phase oscillations. The results obtained for the case $\phi_8 = 90^\circ$ (no acceleration) agreed with theoretical values within ± 0.5 parts per hundred.

The measurements of the effect of hum resonances are being carried out at present, and preparations have been made for the studies of transition phenomena.

Some changes in the arrangement of the computer will allow to simulate the conditions of phase-locked beam control, and corresponding experiments are in preparation.
6. **INJECTION LINEAR ACCELERATOR** (H.G. Hereward)

The most important activity of the past six months has been the installation of equipment in the Linac Wing, as follows:

- Faraday cage, erected complete.
- Pumping system of 500 KV column, installed and working.
- High Tension generator (500 KV), installed.
- Tank I vacuum envelope and pumping system, installed and working.
- Tank II vacuum envelope and pumping system, 80% installed.
- Power distribution system, installed and working.

A considerable amount of work has also gone into testing and modifying the 2 MW Radio Frequency generators, which were not very reliable when delivered by the firm. These have now been tested up to 2.5 MW and appear to be satisfactory. Parts of the Radio Frequency system of the Linac are now ready for installation in the Wing.

The liner and most of the drift-tubes of Tank I have been received, and some damage suffered by the liner in transit has been repaired. It is ready for cleaning and assembly of drift-tubes.

Other work of the group is going forward approximately as planned. In particular, the pulsed focusing magnets for Tank I and the new drift-tubes to contain them are in production, the bending magnets of the inflector system have been ordered, and we are in course of selecting a supplier for the matching quadrupole lenses from a number of tenderers.

Work with the experimental set-up of vertical accelerating column and ion-source ended in August when the transfer of the 500 KV set to the Linac Wing began. At this time the pulsed beam intensity was 40 ma at the bottom of the column and the measurements suggest that more current would be available by further improvements to the lens system. Some difficulties were experienced in making the horizontal accelerating column, and several vacuum leaks in it had to be repaired. It is now vacuum tight and has been tested for mechanical strength and is being installed.

7. **ELECTRICAL ENGINEERING** (F. Grütter)

a) **Power Engineering**

Part of the equipment for the PS Main Substation has been delivered by the manufacturers; the rest will follow early November. Installation has already started.
A detailed scheme for the remote control of the substation and other parts of the Power House has been completed and an order for the required additional equipment will soon be placed.

The power distribution system is nearly completed in the Experimental Hall "South" and in the Linac Wing. In the Ring Building the distribution systems for the services are completed, and 380/220 V cables are already laid for supplying the vacuum and the RF systems. Power distribution equipment is also being installed in the Experimental Hall "North" and in the Central Building. An order has been placed for distribution boards and panels in the PS Power House.

The magnet power supply is nearly completed at the manufacturers. The M.G. set, including the Scherbius regulation, will be erected and tested at the Brown Boveri workshops in Mannheim, and one of the power converter sets will be subjected to load tests at the Baden works of Brown-Boveri.

Possible methods for achieving a slow rate of rise of magnet current at the start of the pulses have been investigated.

c) **Cabling and Controls**

The installation of cable trunking is nearly finished in the Linac Wing, and orders will soon be placed for trunking in the Ring Building and the radial tunnels.

Planning of the control system in general and detail design of control devices for the various components of the synchrotron have continued.

Specifications for the intercommunication and public address systems in the Linac Wing and the PS Power House have been written and were sent off to possible tenderers.

8. **MECHANICAL ENGINEERING** (C.J. Zilverschoon and G.L. Munday)

a) **Cooling System**

The pipework for the well water supply in the ring is being installed; the necessary drain pipes are already in place.

The installation of the aluminium pipes for the magnet cooling system is about to start, and the fabrication of the heat exchangers and other parts of the system is progressing satisfactorily.

b) **Vacuum System**

Four types of vacuum chamber were under consideration when the specifications were sent out to tender. When the offers arrived
it was possible to assess the value of each type from the technical and economic point of view. Finally the so-called thick-walled (2 mm) type was chosen. A contract was made with the Usines Jean Gallay of Geneva for its manufacture. The high alloy steel called Fluginox 150 for the chamber is being manufactured with very tight tolerances on the permeability and overall resistivity by Aciéries Ugine, Gueugnon. About half the total quantity of sheet steel has already been rolled and is about to be measured.

The specifications for the pumping equipment were sent out to fifteen manufacturers; complete or almost complete offers were received from eight manufacturers. These offers were for complete pumping stations using oil diffusion pumps, but it is possible that one offer using getter-ionization pumps may arrive later. The tenders are now being examined in detail and it is hoped to place the contract shortly.

9. SURVEY (A. Decae)

A great deal of work has gone into the development of combined supports for the theodolites and microscopes to permit simultaneous readings of angles and lengths during the positioning of the magnet units. It is important that these quantities can be measured during the shortest possible time to limit the errors due to the concrete beam deformations. These supports are being designed and manufactured by Wild, Heerbrugg, with the collaboration of S.I.P., Geneva, and are required to remain within 0.01 mm accuracy.

Special pulleys using knife-edge bearings instead of roller bearings have been developed by PS Workshop to stretch the invar wires used for the length measurements. The results obtained so far show a 0.5 gr sensitivity under a 20 kg charge, which is about 100 times better than the usual metrology pulleys.

An "electric eye" is being developed in Berlin by Askania for our theodolites. This device will allow the taking of a great number of angular bearings in a short time and increase the present accuracy of the theodolites. They could also be used later on as automatic controls of stability when the machine is working.

Studies of the optical refraction in the Ring Building are being carried out and it has been found that the temperature corrections are very hard to compute correctly for long sight paths. It seems easier, in most cases, to stir the air at random along the sight line and to rely on a statistical compensation. Other methods are also being tried.

Dynamical measurements of the complete annular beam have given very satisfactory results. Vibrations were induced at a given point and the consequent amplitudes of oscillation recorded in several places around the beam. The period of oscillation (∼1 sec) and the wave lengths fell within 10% of the theoretical computations of the civil engineers Messrs. Fietz & Hauri.
The invar wires between the eight geodetic monuments and the central monument have been installed and a record is now being kept of the changes of dimensions of the foundations. These changes are periodic (T ~ 15 days) and reach up to now a maximum of about 0.5 mm across the diameter. This is in good agreement with the results of the survey on the underlying rock which have been obtained by surface triangulation and depth pendulums.

Apparatus has been set up to record the differential movements between the annular beam and the individual monuments, and also the changes of curvature of the beam in the octogonal sectors.

The first results show periodic deformations, probably due to temperature changes. The internal temperatures of the beam are being measured regularly, as well as the ambient air temperatures, and these records will enable us to apply the necessary corrections to the survey measurements. It is necessary, however, to wait until the climatization is in full operation to reach any definite conclusions as to the likely deformations of the beam and the method that will have to be used to set up the magnets.

10. BUILDING WORK

The offices, laboratories, experimental halls and the ring complex are all completed and occupied by the PS Division. There remain several small installations, mainly services, to finish. In the ring complex the annular concrete beam is now floating free on the foundations and is complete with the dampers and water circulating system. The climatization system is now in full operation and although the building has not yet reached equilibrium conditions, accurate measurements are already being carried out on the stability of the whole structure. It is too early yet to give any definite results.

Apart from some road work yet to be finished, the last major building to be completed is the Power House, which will contain the magnet generators, water cooling apparatus and electrical substation for the whole machine. It is hoped that this building will be finished before the end of the year. Although the substation section of this building is by no means finished, it has been possible to start installing the electrical equipment in order that the present temporary power distribution, which is causing some anxiety to the Division, can be replaced by the final installation by the end of the year.
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DIVISIONAL DIRECTORS PROGRESS REPORTS

SYNCHRO-CYCLOTRON DIVISION
PROGRESS REPORT

SYNCHRO-CYCLOTRON DIVISION

(15 May - 15 November, 1957)

by W. Gentner

1. MACHINE PROGRAMME

All the major components of the cyclotron were brought into operation in this period and protons were accelerated to the full energy for the first time on 1 August. A large number of modifications have had to be made to the radio frequency system, the most serious of these being to the tuning-fork drive. The magnetic damping of the tuning-fork was considerably larger than the model tests had shown and the existing drive was not strong enough. Temporary modifications have been made and a final driving mechanism will soon be installed. Some time was spent also in eliminating resonances in the radio frequency modulation cycle where the oscillator went out of oscillation. It has been found too that the radio frequency heating of the tuning-fork is serious and the radio frequency must be pulsed. The pulser has now been brought into operation. A new feedback system for the tuning-fork has been installed and works very well. Both ion sources, the arc source and the cold-cathode source, have been tested and both give satisfactory circulating beam currents, though more in the case of the cold-cathode source (\(\geq \frac{1}{10} \mu A\)). The beam now goes out to the full radius without losses. Although the major difficulties of the tuning-fork seem to have been solved, the construction of the rotating condenser is proceeding satisfactorily. The final neutron wall with meson and neutron channels has been built and the lifting platforms now work well.

All of the bending magnets for beam-focusing have now arrived and their fields have been measured. The strong-focusing quadrupoles for the proton beam have been delivered. All the apparatus for the extraction of the proton beam is ready. The first bending magnet for the internally produced mesons has been installed. A preliminary health survey has been carried out with the help of the STS Division. It appears that the shielding of the machine will be very good.
2. RESEARCH PROGRAMME

The three counter groups are now ready with their equipment and preliminary trials have already been carried out on the cyclotron. Three liquid hydrogen targets are under construction and the first scattering tables are ready.

The polarized proton injector has now been completely designed and is under construction. The muon-channel has been designed and will shortly be put out for tender.

The emulsion group has now been formed, but the chemistry group cannot be started until the new building is ready.

The spallation group has started work on targets irradiated for them in the Uppsala cyclotron.

The parity experiments with radio-active sources are being completed and results obtained so far have been published.

The joint SC/STS electronics group came over completely to the SC Division on 1 July, and the joint SC/STS bubble chamber group went to STS. A wiring pool has been formed in the electronics group.

The Advisory Committee on visiting groups has had its first meeting (CERN/SPC/48), and a tentative programme for visitors agreed. It has been suggested that those groups who have had no experience with high energy machines should send one man before they come to get experience working with an internal team. The necessary arrangements for this are being made.

3. PRESENT STAFF

Including CERN Fellows in Geneva and abroad: 115.
4. PUBLICATIONS

Morpurgo, M. : "On a $\mu$-mesons focusing device" (CERN/SC/4114/Exp/141)

Morpurgo, M. : "On a $\mu$-mesons focusing device" (CERN/SC/141 bis)

Keller, R.: "Projet d'une source d'ions polarisés" (CERN/SC/142)

Citron, A.; Øveras, H.: "On a focusing channel for collecting $\mu$-mesons from $\pi-\mu$-decay in flight" (CERN/SC/143)


Krienen, F.: "Motion of charged particles in rotating fields" (CERN/SC/145)

Øveras, H.: "On a problem in multiple scattering of particles with varying energy" (CERN/SC/146)

Lundby, A., Patro, A., Stroot, J.P.: "Circular polarization of $\gamma$-rays emitted opposite to $g$-particles. Results on $46\gamma$sc" (CERN/SC/147) (to appear in Nuovo Cimento)


Farley, F.J.M.: "A high speed pulse amplitude discriminator" (CERN/SC/149)

Lundby, A., Stroot, J.P.: "Interactions faibles et parité en physique nucléaire" (CERN/SC/150) (Industries atomiques, décembre 1957)

Keller, R., Fidecaro, M., Barbier, M.: "Calcul d'orbites dans un synchro-cyclotron d'après les données techniques en considérant la charge d'espace - l'analogie avec l'oscillateur anharmonique" (CERN 57 - 45).
DIVISIONAL DIRECTORS PROGRESS REPORTS

SCIENTIFIC AND TECHNICAL SERVICES DIVISION
PROGRESS REPORT

SCIENTIFIC AND TECHNICAL SERVICES DIVISION

(1 June - 30 November, 1957)

by L. Kowarski

1. GENERAL REMARKS

The period under reference coincides with a general transition of CERN from a predominantly building stage towards an initial stage of marked scientific activity. The necessity of corresponding changes in CERN's initial structure has been recognized (see the documents CERN/GD/127 and CERN/SPC/46); as a step in this direction it has been decided to put more stress on the technique-developing activities of STS (including the full responsibility for the development of bubble chambers) and to transfer to other Divisions some of its other technical tasks.

Permanent premises at Meyrin became available for the Scientific Information Service in the first half of September, and for the other sections of the Division in the second half of November.

2. LIQUEFIED GASES

The complete hydrogen liquefaction plant (liquefier, purifiers, compressors, pumps, gasholders) was assembled in July; numerous trial runs were satisfactorily performed in collaboration with our Leiden consultants. In the present state of the plant 30 lit/hour can be produced currently; with additional compressors etc., the production can be expanded, if needed, up to a ceiling of 100 lit/hour (which has actually been reached by our liquefier during its testing in Leiden).

A portable hydrogen detector is used for monitoring. The highest concentration of hydrogen in the atmosphere of the plant is largely below the explosive limit.

Liquefaction runs will be carried out in December to cover the already formulated needs of the SC Division.
3. **Bubble Chamber Development**

The construction of the main components of the 10 cm chamber was completed by the end of June, and since July the main activities are those of assembly and testing. These operations take considerable time and effort owing to the complexity of the material and to the initial lack of experience of our staff both in cryogenics and in bubble techniques. This first small chamber, in addition to its expected serviceability as a detecting device, will have performed a useful function as an occasion for initiation and training.

Pressure tests, in particular those of the chamber itself (including its glass windows and the pressure tank) were satisfactory; they made use of strain-gauge and stress-coat techniques. Leak tests, after yielding the usual contingent of leaks, were brought to a satisfactory conclusion.

Testing at liquid-gas temperatures has begun. The assembly of the main vacuum system, delayed by a delivery of faulty pumps, is now in progress. Lighting and photography devices are being tested. An expansion system using two successive valves for quick recompression has been tested successfully. In collaboration with the Electronics section (now in the SC Division), work on chamber controls is nearly completed.

Work has started on the design of the 30 cm chamber; stainless steel for its vacuum tank has been ordered. Tests on the magnetic behaviour of stainless steel (for the chamber itself) at low temperatures are being carried out in collaboration with the University of Grenoble.

4. **IEP Development**

The first prototype instrument is now undergoing preliminary tests. In this version, the manual operations are the centering of successive points of the two-dimensional track images on a reticule, and the transfer of their coordinates, by means of a push button, onto a punchtape. The images of the track are projected on a screen by an objective, mounted on a high precision mechanical stage. The motions of the stage are measured by the Ferranti optical devices using moiré fringes. The counting of the fringes, and the coding of this count for the tape record are made by a special instrument developed in cooperation with the Electronics group, using transistors and printed circuits. Additional information such as event identification and coded signals can be recorded on the tape by a special keyboard.
Work has been started on the programming of the Mercury computer for the interpretation of the tapes. The measurements is based on a sequential recording of the stereo-scopic views of each event. Methods of spatial reconstruction of the events, taking into account the optical corrections and especially suited for the computer, have been developed; their coding is in progress.

As a further development, the mechanical stage of the first prototype will be fitted with servo-motors, which will enable the observer to "drive" along the track, taking down the digitalized data as he progresses. The electronic circuit already incorporates a buffer memory adapted to this use. Following the example of Brookhaven, another prototype instrument based on the recording of direction of lines, instead of coordinates of points, is also envisaged with the purpose of rapid analysis of the first bubble chamber pictures, which will be taken at the cyclotron, with no magnetic field applied to the chamber.

Two papers on IEP were given at the recent international conference on electronic instrumentation, organized by CERN. Information is being supplied to outside laboratories engaged, or about to engage in similar work.

5. **ELECTRONIC COMPUTATION**

Recruitment activities were recently resumed in the anticipation of the delivery of the Mercury computer in the Spring of 1958. Work has been done on the following problems:

(a) PS orbit calculations. - A detailed survey has been made of the numerical methods available for this calculation and a desk-machine trial calculation has been carried out. The problem is now ready for detailed programming.

(b) IEP. - See above under 4.

(c) Analysis of the stability of a proposed "pinch-effect" particle accelerator; calculations completed on a DEUCE in London.

(d) Output and data-presentation devices; a survey of commercially available high-speed tape punches, printers and graph-plotters has been carried out in view of an attempt to improve the speed of the Mercury's output.
Conversations with I.B.M. are in progress with the object of obtaining access to the Paris computer for some preliminary testing of the IEP scheme.

6. HEALTH PHYSICS

A programme of monitoring activities and of research (necessary to meet the special characteristics of radiations which will be encountered in our laboratories) has been defined and adopted; the necessary equipment has been assembled and collaboration with radiological services in Geneva has been established. Regular assistance is being given to the Linac group and to the SC Division according to its present needs.

7. SCIENTIFIC INFORMATION

Since the move from Cointrin to Meyrin the use of the Library has greatly increased: the number of loans in October 1957 was more than double those made in October 1956, and the Library is increasingly used as a place of work for extended periods. More books and periodicals are being duplicated and maintained as reference copies. Temporary and apprentice (stagiaire) personnel are at present relied upon for help, but some increase in the Library's permanent staff may prove necessary in the near future.

About 20 new exchange agreements have been established. Much effort has been devoted to procuring preprints: some 600 scientists in 28 countries were approached. Since July a monthly average of 35 preprints have been received.
DIVISIONAL DIRECTORS PROGRESS REPORTS

SITE AND BUILDINGS DIVISION
1. CONSTRUCTION AT MEYRIN

General

During this period the construction work progressed quite satisfactorily. The weather was favourable and work could proceed with little interruptions. The number of workmen employed by contractors during the period under review varied between 500 to a peak of 932 in June. The number of workmen for building work was sufficient but there have been some difficulties in obtaining sufficient qualified electricians for installation work.

It should be noted as a matter of interest that contractors are now sending in their accounts much earlier than in previous years and this is no doubt due to the general financial situation.

Progress of Construction

1) PS Building

a) Ring

Construction work and services for the Ring are now, with minor exceptions, completed. The ventilation system is under final tests and so far as can be seen at present, it will meet the specified requirements. SB Division has now to take over the operation and maintenance of this plant.

b) Generator Building and Sub-Station

This is the last unfinished building of the PS complex. The interval between the time the PS Group could give all requirements and the completion date is very short and all efforts have been made to keep within this limit period. The concrete work proceeded extremely well and the finishing work is also being pressed. The installation of PS control equipment has already started.
c) **Experimental Halls and Laboratories**

All PS staff, with the apparatus, have now left their temporary accommodation at the Institute of Physics, in Geneva, and moved into their permanent laboratories and offices. The experimental halls are also in use by the PS Division and the necessary installations have been made to enable the testing and erection of magnet blocks to proceed. The railway transportation system for movement of magnets into the Ring is also installed and working. Baryte blocks to be placed underneath the shielding bridge in the experimental hall are being manufactured.

2) **SC Building**

Building work is complete and the two hydraulic lifting platforms are installed.

3) **Laboratory Wings**

Laboratories in Wing I are all occupied by SC and STS Divisions. STS Division is now moving into Wing II.

The Library and Theoretical Group have been transferred from Cointrin to their permanent accommodation. Some installation services in the basement have yet to be completed.

The concrete work for Laboratories in Wing III is practically complete and internal work is proceeding. Construction is also in hand of the radioactive effluent delay tank necessary for use with the radio-chemical laboratories being equipped in Wing III.

4) **Main Building**

The work is now proceeding on the basis of the reduced programme as discussed and decided in May 1957. The foundations are practically complete.

5) **Main Workshop**

Apart from some internal fitting work, the building is now finished and the majority of machine tools are installed and operating. The Sub-Station for distribution of electricity to the Laboratory Wings is complete and has been put under tension.
6) **Liquid Hydrogen Building**

This building has now been handed over to STS.

7) **Power House**

The electrical site Sub-Station is now directly energised using the new 18 kV feeders from "La Renfile" station. It is hoped to put the emergency Diesel Generator into service by the end of the year when the remaining electrical equipment, which has been delayed, will be delivered. The new oil storage tanks for fuel oil have been installed and advantage taken to have them filled before the winter period.

The office part of the building is now complete and occupied by SB Division staff.

8) **Water Pump House and Sewage Works**

The sewage treatment plant is operating and all cooling water pumps have now been installed. Their electrical connection is under completion.

9) **Surroundings**

The levelling of the ground is progressing and grass has been sowed on the finished parts. It is now possible to execute the final street lighting.

2. **STAFF**

With the increased responsibilities of SB Division, as the Site is completed and other Divisions take occupation of their permanent accommodation, there have inevitably been increases in staff. The Director-General's decision to transfer responsibility for the Main Workshop from STS to SB Division involved an increase of 59 staff, of whom 5 are on loan outside the workshop; and there has also been an increased demand on SB Division services to execute work which it was not considered expedient to put out to contract.

At the end of October 1957 the total staff was 118 plus the Main Workshop staff mentioned above. This compares with a total of 95 for the period ending April 1957. Once again, notwithstanding this increase of staff, it has been necessary for many members to work overtime.
3. OPERATIONAL AND MAINTENANCE SERVICES

This has been a particularly difficult transitionary period with the coincidence of divisional movements into new premises and the putting into service of new installations. To avoid the minimum inconvenience to staff and research generally, a certain degree of improvisation has been necessary. Nevertheless, with minor exceptions, it has been possible to provide good and uninterrupted services to our client Divisions.

The approximate consumption of electrical energy on the Site from 1 May to 31 October, 1957 was 1'600'000 kwh, an increase of about 60% over the previous 6 months, or three times the consumption of the corresponding period in 1956. The maximum demand was 1'700 kva during the period under review.

As is to be expected at this stage, the work of maintaining the existing buildings and equipment represents only a small part of SE Division work and numerous requests for special installations and work from other Divisions continue to be received.

4. MAIN WORKSHOP

The move of all machines - about 50 in number - and equipment from Cointrin to Meyrin, as well as their installation in the new premises has been dealt with in a very short time and exclusively by the regular Workshop staff. The normal output was only slightly affected by the move, which took place during the holiday period. A complete inventory and control system have been drawn up. Now that the Workshop is installed in its final premises, its internal organization is being reviewed.

5. COMMON SERVICES

1) Transport

Apart from its normal duties the Transport section has been responsible during the period under review for the movement and installation at Meyrin of PS staff from the Institute of Physics, of the Theory Group, part of STS, the Library and the majority of the Administration Division from Cointrin. The Director-General's office will move at the end of November into provisional accommodation on the Site.

The following figures indicate the scale of movements that have taken place: Number of passengers carried: 3,199 -
Number of kilometers: 112,272 - Tonnage handled: 9,923 tons - Number of long distance journeys: 10 - Ambulance to Doctor: 6 times - Ambulance to Hospital: 32 times.

A very heavy programme of transportation activities has now commenced in connection with the installation of PS equipment and this is likely to impose a heavy burden on this section in the forthcoming months, especially on the small specialist team for heavy lifting work.

2) Fire Services and First Aid

There have been no serious fires during the period under review, but the Fire Service has been very active in connection with the training of personnel, and fire protective services generally. As this section provides the necessary First Aid Services, the personnel has also been subject to numerous demands on their services, especially for First Aid to the constructional staff. In addition, selected personnel have been given a training in the rudiments of First Aid. It is to be noted that good progress has been made by constant vigilance to reduce the number of accidents. Our Safety Officer, working in close cooperation with the Safety Committee, has been able to effect many improvements. The Safety Manual previously referred to, containing safety codes of practice, has now been issued to members of CERN staff and has been well received.

3) Site Security

In connection with the control of access to the Site mentioned in the last report, quite apart from CERN and contractor's personnel, the large number of visitors has entailed a considerable amount of work in this respect; for example during this period 3,500 passes have been issued. The problem of Site security at this stage of construction, however, remains difficult.

4) Facilities for Staff

With the augmentation of staff working at Meyrin, the number of users of the provisional canteen has naturally increased and there is an average attendance of 280 persons at lunch time.

Car-washing facilities for the staff will be provided at a site near the Power House, according to decision made by the Director-General.

Provisional accommodation has also been made available for the staff language classes and a room allocated for a games/reading room.
DIVISIONAL DIRECTORS PROGRESS REPORTS

THEORETICAL STUDY DIVISION

3974/E
The staff situation of the Theoretical Division is as follows:

Prof. B.G. Ferretti
Dr. B.G. d'Espagnat
Dr. J. Prentki
Dr. F. Cerulus
Dr. H. Hagedorn
Dr. A. Petermann
Prof. V.F. Weisskopf
Dr. G. Molière
Dr. K. Wildermuth
Dr. T. Kanellopoulos
Dr. W. Glaser
Dr. A. Bodmer
Dr. S. Fubini
Dr. B. Bosco
Dr. R. Omnes
S. Kühler
C. Fröndal
J. Yoccoz
P. Sergent
D. Speiser
Dr. Y. Yamaguchi
Dr. T. Toyoda
Dr. H. Überall
Dr. A. Salam
Dr. A. de Shalit
Prof. D.R. Inglis
Dr. L. Wolfenstein
W. Froissart

Divisional Director
Staff member
Staff member
Staff member
Staff member
Staff member
Guest Professor
Senior Fellow
Senior Fellow
Senior Fellow
Senior Fellow
Senior Fellow
Senior Fellow
Senior Fellow
Fellow
Fellow
Fellow
Fellow
Fellow
Fellow
Fellow
Ford Fellow
Ford Fellow
Ford Fellow
Ford visit. sc.
Ford visit. sc.
Visite scientifique
Visite scientifique
Visitor (Saclay)

joined 1 Sept. 1957
1.6.57 - 4.8.58
5.7.57 - 4.7.58
1.9.57 - 31.8.58
10.9.57 - 9.9.58
1.10.57 - 30.9.58
1.10.57 - 30.9.58
1.11.57 - 31.10.58
1.11.56 - 31.5.58
1.5.57 - 30.4.58
1.7.57 - 30.6.58
15.8.57 - 14.8.58
1.9.57 - 31.8.58
1.10.57 - 30.9.58
1.1.58 - 31.12.58
1.5.57 - 1.2.58
1.10.57 - 30.9.58
1.10.57 - 30.9.58
short visits
1.10.57 - 30.9.58
16.9.57 - 1.9.58
1.10.57 - 30.9.58
Research Work and Programme

The Theoretical Division has been divided into 3 sub-groups. The first group is working on low energy nuclear physics, the second on pion physics, nucleon structure and field theory, and the third on strange and newly discovered particles.

Professor Weisskopf and Professor Inglis are in charge of the first group; Dr. Fubini and Dr. Petermann of the second group, and Dr. d'Espagnat and Dr. Prentki of the third one.

Sub-groups meetings and discussions are held every week.

The second sub-group is collaborating particularly with the SC Division, whereas the third sub-group collaborates with the PS Division for the preparation of the experimental programme.

Research related to pion physics

It may be mentioned that research on the reactions:

\[ \pi + N \rightarrow \pi' + \pi'' + N \]
\[ \pi + N \rightarrow \pi' + \gamma + N \]

as well as research on the pion production by electrons and on higher order corrections of the nuclear structure have been terminated.

Research on the Coulomb correction for the reaction:

\[ P + D \rightarrow \ ^{3}\text{H} + \pi^0 \]
\[ P + D \rightarrow \ ^{3}\text{H} + \pi^+ \]

is proceeding, and research on a possible relation between the quadrupole momentum of the deuteron and form factor of nucleons is planned. Furthermore, calculations about phenomena connected with \( \pi^0 \) decay are being made, with a view to possible experiments with the SC.

Finally, research on the process of nucleon–antinucleon annihilation is going on.

As regards field theory, it is planned to study the analytical behaviour of Green's functions and research is in progress on the Thirring 2-dimensional model.
With regard to the activities of the third sub-group, investigations have been made on weak coupling, on hyperon decay, and on the $K^+ - N$ and $KK\pi\pi$ interactions, and it is intended to study the law of conservation of nucleons.

The third sub-group is also carrying out calculations on multiple pion production and on the production of antinucleons, which should be used in connection with the planning of experimental research with the PS.

Members of the Theoretical Division are giving seminars, and will soon start a regular course of lectures for experimental physicists in the other Divisions.

Joint Colloquia

The Joint Colloquia with the Institut de Physique of the University of Geneva are now being held at the CERN site under the supervision of the Theoretical Division. The following colloquia have been held until now:

List of Joint Colloquia

PS Conference Room CERN
Geneva, 1957

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 October</td>
<td>Prof. V.F. Weisskopf</td>
<td>On properties of nuclear matter</td>
</tr>
<tr>
<td>30 October</td>
<td>Prof. E.R. Caianiello</td>
<td>The brain : human and mechanical</td>
</tr>
<tr>
<td>6 November</td>
<td>Prof. Lindenbaum</td>
<td>Collisions of particles having energy of $\sqrt{s}$ BeV with nuclei</td>
</tr>
<tr>
<td>13 November</td>
<td>Prof. W. Heisenberg</td>
<td>General remarks on the theory of elementary particles</td>
</tr>
<tr>
<td>20 November</td>
<td>Prof. G. Bernardini</td>
<td>The structure of the nucleon. The ground states and the resonance state of the pion-nucleon system.</td>
</tr>
<tr>
<td>27 November</td>
<td>Prof. O. Chamberlain</td>
<td>Antinucleons</td>
</tr>
<tr>
<td>4 December</td>
<td>Prof. H.S.W. Massey</td>
<td>Problems in ultra-high energy physics.</td>
</tr>
</tbody>
</table>
DIVISIONAL DIRECTORS PROGRESS REPORTS

ADMINISTRATION DIVISION
PROGRESS REPORT

ADMINISTRATION DIVISION
(1 June - 31 December, 1957)
by J. Richemond

In 1957 the Administration Division has had to deal with a considerable increase in work compared with 1956, though its staff has hardly increased at all.

The figures given for each of the three services which compose the Division confirm this development.

This was also specifically noted by Dr. Telschow, one of the three members of the Staff Advisory Committee, who pointed out at a meeting of the Finance Committee that administrative expenses remained extremely low.

As the Administration Division has had to set an example and save, it has been led to accept this situation during the whole of 1957, though the increased effort required of it has proved at times hardly possible to sustain and some of its work has increasingly lagged behind, particularly in connection with accounting.

It had been hoped that CERN's activities would reach their peak in 1957 and that a recession would set in in 1958 when the construction of the PS and of all the buildings would be reaching completion, so that it would be possible to make up for delays and subsequently to spread more evenly the many tasks of the Division.

Unfortunately as the 1958 Budget will not be substantially lower than the 1957 Budget, no real alleviation may be expected next year. Accordingly it is but fair to give advanced notice that measures will have to be taken in due course to reinforce some of the teams that are notoriously understaffed.

*   *   *

3974/E
Another cause for concern arises from the systematic use of competitive tendering between the main firms in Europe to order our equipment, from the stringent specifications and tolerances laid down by the Divisions and from the exacting manner in which all the contracts are negotiated and placed. This general policy has been followed during the last few years, and it has had the fortunate result that exceptionally high quality equipment has been purchased at a total price which is certainly 30% lower than that which any of the Member States would have had to pay, if it had had to purchase all this equipment from its own industry. However, this immediate financial gain can have serious implications for the future, which should be pointed out. CERN has gradually acquired with its main prospective European suppliers the reputation of being a difficult customer from a technical point of view as well as an exacting one regarding prices and contract conditions, with the result that it is becoming increasingly difficult to find reliable firms that are willing to tender; as an example, we may mention the fact that of the 17 firms invited to tender for the poleface windings of the Proton Synchrotron magnet only 3 have actually submitted tenders.

Such a development can no longer prevent CERN from implementing its initial programme, since all the main contracts have been placed; but, henceforth, our methods should undoubtedly become (to some extent) more flexible if new projects of some magnitude are to be undertaken in the future.

* * *

The new grade structure for the staff, which is intended to remedy some of the defects of the old structure, will come into effect on 1st January, 1958. The difficulties which it is attempted to overcome are those connected with the cooperation in a close knit enterprise of groups of personnel with extremely different backgrounds (university, office work, industry).

In the new compromise which has been adopted an endeavour is made to treat all these staffs in the same way. Experience will show whether it is satisfactory or whether it will have to be amended.

The difficulties of recruiting engineers and technicians in the Member States, which are in the throes of economic development are increasing daily.
The salary rise proposed at the end of the year does not in itself provide a solution, since it only takes into account the fall in purchasing power in Switzerland and in the Member States, and not the change in the relative supply and demand position. It is possible that the problems connected with the recruitment of certain classes of staff may one day have to be solved on their own merits.

FINANCE OFFICE

The table below shows the widening gap between increases in staff and the growth of the work undertaken in 1957, as compared with 1956.

<table>
<thead>
<tr>
<th></th>
<th>1956</th>
<th>1957</th>
<th>Increases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of staff</td>
<td>14</td>
<td>18</td>
<td>30%</td>
</tr>
<tr>
<td>Purchase orders</td>
<td>9.200</td>
<td>14.000</td>
<td>52%</td>
</tr>
<tr>
<td>Invoices</td>
<td>13.500</td>
<td>24.000</td>
<td>78%</td>
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<tr>
<td>Payment orders</td>
<td>2.250</td>
<td>3.900</td>
<td>73%</td>
</tr>
<tr>
<td>Number of accounts</td>
<td>1.000</td>
<td>6.875</td>
<td>59%</td>
</tr>
<tr>
<td>Accounting machine journals</td>
<td>700</td>
<td>1.200</td>
<td>71%</td>
</tr>
<tr>
<td>Entries</td>
<td>40.000</td>
<td>80.000</td>
<td>100%</td>
</tr>
<tr>
<td>Contracts</td>
<td>130</td>
<td>220</td>
<td>69%</td>
</tr>
</tbody>
</table>

Budget

As it does every year, the Finance Office prepared a draft Budget for the Financial Year 1958. At the request of the Finance Committee, estimates of expenditure for the Financial Year 1959 have been added to this Budget for every subheading. On the other hand, the Finance Committee recognized that it was impossible at present to estimate with a sufficient degree of accuracy expenditure for the financial year 1960, particularly in respect of the equipment and expenses connected with experimental research on the Proton Synchrotron. Consequently no long-term Budget covering a three year period has been submitted to the high authorities of the Organization.
Other documents have been prepared, however, to show the consequences of possible cuts in the proposed Budget estimates.

Budgetary work has in fact been much more engrossing and much more complicated this year than in previous years.

Financial resources

The management of the Organization's financial resources has proved a difficult task in 1957 as delays occurred in the payment of a number of contributions.

It has been necessary, therefore, to defer certain payments, to make use of the working balance which has now definitely shown itself to be insufficient, and finally, at the end of the year, to arrange for a short-term overdraft with the Bank.

In order to avoid the recurrence of the same difficulties in 1958, the Director-General will request the Member States to pay their contributions in three instalments at the beginning of the first three quarters of the year and he will ask for an increase in the working balance as soon as possible.

Social security

The insurance policy for accidents incurred in the course of duty has been reviewed and finally adjusted. It became effective with retrospective effect from 1 January, 1957.

The management board of the staff insurance scheme has had to provide the actuary with a number of statistical data to enable him to draw up his initial actuarial balance sheet. The organization of the accounting system for the scheme is about to be completed.

Accounting section

Apart from its normal duties, the accounting section has begun to organize the simplified analytical accounting system which CERN requires in order to keep a better check on certain expenses, such as those connected with the operation of the Main Workshop and with experimental research. The initial results of this work should be available at the beginning of 1958.

Statistical data are being collated to determine the construction costs for each building and for each of the building trades.
Internal audit section

The internal audit section performed its duties in accordance with the provisions of the Financial Rules. It had to devote an appreciable part of its time to the scrutiny of contracts and purchase orders, particularly with a view to keeping commitments for 1958 as low as possible.

The section has dealt with the reimbursement of Swiss federal taxes and especially of the Swiss sales tax (ICHA), and it carried out spot-checks as a means of permanent control of the inventory (15,000 items at the end of 1957).

PERSONNEL OFFICE

The general section activities of this office are outlined below. Outside of these, the office has handled various other matters, among which may be mentioned:

- the development of the new grading and salary scheme for CERN staff. This is now nearing completion and will be operated from 1st January, 1958.

- the co-ordination of staff arrangements and recruitment for the CERN and FORD fellowship programmes

- a survey of local and international conditions which has led to the request for improvements in the present CERN salary and allowance conditions

- participation in a United Nations sponsored investigation into Geneva conditions of employment

- collaboration with the staff review team during their recent investigation of the CERN staffing programme

- the development of the 1958 recruitment programme. Details of this will be circulated to Member States as soon as a more definite idea of the final totals to be approved is known

- the Personnel Officer has represented the Director-General as an observer on the Working Group organized by the Council of Europe to investigate problems connected with a European Civil Service.
The Personnel Section has been responsible for the satisfactory fulfilling of the 1957 recruitment programme which, while resulting in an increased intake compared with 1956 (213 against 167) has required more and more effort to attract new staff as outside competition increases. It is obvious that CERN conditions, at least in certain countries, are no longer as attractive as they used to be.

The following data show the position for the period 16th November, 1956 to 15th November, 1957, and may be compared with the figures given in the December 1956 report (CERN/197).

<table>
<thead>
<tr>
<th></th>
<th>L+S</th>
<th>Tech.</th>
<th>Adm.</th>
<th>Ancy</th>
<th>Fellows</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff at 15.11.56.</td>
<td>104</td>
<td>154</td>
<td>64</td>
<td>82</td>
<td>23</td>
<td>427</td>
</tr>
<tr>
<td>Staff at 15.11.57.</td>
<td>115</td>
<td>237</td>
<td>78</td>
<td>126</td>
<td>38</td>
<td>594</td>
</tr>
<tr>
<td>Net increase</td>
<td>11</td>
<td>83</td>
<td>14</td>
<td>44</td>
<td>15</td>
<td>167</td>
</tr>
<tr>
<td>Terminations</td>
<td>9</td>
<td>6</td>
<td>9</td>
<td>7</td>
<td>15</td>
<td>46</td>
</tr>
<tr>
<td>Total recruitment</td>
<td>20</td>
<td>89</td>
<td>23</td>
<td>51</td>
<td>30</td>
<td>213 (+28 %)</td>
</tr>
</tbody>
</table>

Selection Boards : 85
Candidates boarded : 519

<table>
<thead>
<tr>
<th></th>
<th>L+S</th>
<th>Tech.</th>
<th>Adm.</th>
<th>Ancy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of applications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>received</td>
<td>712</td>
<td>1231</td>
<td>536</td>
<td>534</td>
<td>3013</td>
</tr>
<tr>
<td>Total No. applications received</td>
<td>2363</td>
<td>4167</td>
<td>3396</td>
<td>2149</td>
<td>12075</td>
</tr>
</tbody>
</table>

The distribution of staff at 15th November, 1957 is shown in Table I. In addition to these staff members, 16 Fellows and Visitors, paid under the Ford Foundation, were in CERN at this date.
The Pay, Claims and Leave Section has handled 3248 claims and issued 1481 pay schedules (a monthly increase of about 65%).

The Office Services Sections have handled increasing loads commensurate with the increased staff members.

The Medical Insurance Section handled 2240 claims (+25%) during the year, while the total membership of the Scheme is now 1370 (+52%). The Scheme is working very satisfactorily, and a further agreement has now been negotiated with the "Caisse Maladie" which, while providing for a proper coverage for accident or illness incurred in the course of duty, introduces some economies in the general rates of benefit.

The Travel and Installation Section provided 396 travel bookings (+ about 90%) and arranged 90 removals (+ 32%). In view of the difficult accommodation position which has arisen in Geneva, the section has given more attention recently to this problem, and has been able to arrange accommodation for over 100 staff members and Fellows during the year.

The Mail Section provides a full messenger service at Meyrin and the Mail Office now handles over 12,000 letters etc. each month (+ about 50%).

The Typing and Reproduction Section is working to full capacity with a work load of about 35% above the 1956 level.

The Telephone Service has now been staffed with fully qualified switchboard operators and a partial shift system is in operation.

*   *

The total staff of the Personnel Office is now 34 (+ 13 %).
### CERN Staff as at 15 November, 1957

**Distribution by Functions and Divisions**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D.G.</td>
<td>1</td>
<td>-</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>P.S.</td>
<td>49</td>
<td>90</td>
<td>7</td>
<td>19</td>
<td>3</td>
<td>168</td>
</tr>
<tr>
<td>S.C.</td>
<td>27</td>
<td>52</td>
<td>3</td>
<td>9</td>
<td>20</td>
<td>111</td>
</tr>
<tr>
<td>S.T.S.</td>
<td>24</td>
<td>20</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>57</td>
</tr>
<tr>
<td>S.B.</td>
<td>4</td>
<td>74</td>
<td>4</td>
<td>75</td>
<td>-</td>
<td>157</td>
</tr>
<tr>
<td>T.S.</td>
<td>6</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>ADM.</td>
<td>4</td>
<td>1</td>
<td>50</td>
<td>19</td>
<td>-</td>
<td>74</td>
</tr>
<tr>
<td>TOTAL</td>
<td>115</td>
<td>237</td>
<td>78</td>
<td>126</td>
<td>38</td>
<td>594</td>
</tr>
</tbody>
</table>
PURCHASING OFFICE

The Table below shows the increase in the activities of the Purchasing Office during the last three years:

<table>
<thead>
<tr>
<th></th>
<th>1955</th>
<th>1956</th>
<th>1957</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of orders and contracts placed (in Swiss francs)</td>
<td>9.5 million</td>
<td>29.5 million</td>
<td>15 million</td>
</tr>
<tr>
<td>Number of orders and contracts placed</td>
<td>4,500</td>
<td>7,900</td>
<td>11,500</td>
</tr>
<tr>
<td>Percentage increase in orders and contracts placed compared with previous years</td>
<td>76%</td>
<td>45%</td>
<td></td>
</tr>
<tr>
<td>Number of staff</td>
<td>11</td>
<td>14</td>
<td>16</td>
</tr>
</tbody>
</table>

Thus from 1955 to 1957 there has been an increase of 155% in the number of orders and contracts placed while the corresponding increase in staff is 45%.

In 1957 the main contracts placed for equipment were those relating to the vacuum chamber, the bus bars and the poleface windings for the Proton Synchrotron.

Tenders have been received for the vacuum pumping equipment and the contract will probably be placed towards the end of the year.

With the approval of the Finance Committee, tenders have been invited in respect of the final fire insurance contract - including radiation risks - for the CERN buildings and equipment. These tenders have now been received and are being examined, and it is intended to place the contract by the end of the year or early next year.

For current supplies, it has been possible to maintain continuous contacts with a number of selected suppliers from whom we have been able to obtain very appreciable quantity of rebates.

In spite of the general tendency for prices to rise in European markets, we have always succeeded in negotiating contracts at firm prices.

It should be pointed out, however, that the major European firms are showing a certain reluctance towards our invitations for tenders. Though quite definite, this tendency has not yet hampered us in meeting the requirements of the Divisions.

The move to the Meyrin Site has greatly facilitated the work of the Purchasing Office, with consequent beneficial effects for all the Divisions.