

CERN/123

Geneva, February 9th, 1955.

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

SECOND SESSION OF COUNCIL

GENEVA

24-25 February 1955

INTRODUCTION

by the Director-General

The transition from the interim to the final organization of CERN has been smooth and no abrupt changes have taken place which might have been harmful to the work. Most of the leading Staff members continued and expanded their activities along the lines started before October 1954. A measure of the expansion of CERN during the last five months is the increase of the total staff from 82 to 180. The total expenditures for this period amounted to about five million. The general progress has been satisfactory and is presented individually for the different divisions in the following reports by the Divisional Directors.

The geographical separation between Cointrin and the Institute of Physics and the variety of the activities in the different group called for the institution of the CERN Colloquium. It meets regularly on Wednesday at 5 p.m. and serves the twofold purpose to bring the whole scientific and technical staff together and to keep members of various groups informed about the work carried out by others as well as about related new developments elsewhere. The Colloquium is a joint enterprise with the Institute of Physics of the University and its average attendance has been about 60 persons. The enclosed list of titles serves to give an idea of the variety of topics which have been presented and discussed in the Colloquium.

In accordance with the idea that pure research shall be undertaken in Geneva before the completion of the big machines, the following activities have been initiated under the direction of the Director-General:

1. Theory.

Dr. B. d'Espagnat has moved to Geneva on September 1st, 1954, and Dr. J. Prentki on January 3rd, 1955. Both are on leave of absence from the Centre National de la Recherche Scientifique (CNRS) in Paris, and they work together on the problem of meson production and scattering. A note by d'Espagnat has been published in January in the Comptes Rendus and further details will be published soon together with Prentki.

Dr. A. Abragam has been in Geneva on two extended visits on leave from Sarclay; his work here has resulted in a paper on nuclear magnetism which has been sent for publication to the Physical Review.

2. Nuclear Magnetism.

The apparatus on loan from Stanford has been set up in the Institut de Physique by Dr. Anderson and Dr. Arnold and is now functioning again. Various novel features in the technique of high resolution are now in the design and construction stage.

3. Cosmic Rays.

This activity has been under the direct supervision of the Deputy Director-General.

The programme was approved by the Scientific Policy Committee at their meeting held on December 3rd and was centered along two main lines :

The first one consists in taking over from the DSIR the Jungfrauoch station, which will be run by CERN starting next August. All necessary steps for this transfer have been arranged.

The second line, developed in close collaboration with the Scientific and Technical Services Division, consists in an experiment on the mean life of K-particles. The plan of the experiment has been completed and the construction of the equipment is now in progress.

LIST OF COLLOQUIUM LECTURES

1. "Experimental Facilities for the CERN Proton Synchrotron"
Dr. A. Citron - 27.10.54.
2. "Review of the Alternating-Gradient Proton Synchrotron"
Mr. J.B. Adams - 3.11.54.
3. "RF System for the CERN Proton Synchrotron"
Dr. Ch. Schmelzer - 10.11.54.
4. "Nuclear Resonance under High Resolution"
Dr. F. Bloch - 17.11.54.
5. "Experiments on Proton Resonance Spectra in Liquids"
Dr. J.T. Arnold - 24.11.54.
6. "Strange Particles and their Mean Life"
Dr. E. Amaldi - 1.12.54.
7. "Zoology of K Particles"
Dr. C. Peyrou - 8.12.54.
8. "The Double Production of Heavy Mesons and Hyterons"
Dr. J.A. News - 15.12.54.
9. "Le Spin isotopique et la Diffusion Méson $\tilde{\pi}$ -Nucléon"
("Isotopic Spin and the $\tilde{\pi}$ Meson-Nucleon Scattering")
Dr. B. d'Espagnat - 12.1.55.
10. "The CERN Synchro-Cyclotron"
Dr. F. Krienen - 19.1.55.
11. "The Cerenkov Counter"
Dr. G. von Dardel - 26.1.55.
12. "Orientation Optique des Atomes et des Noyaux"
Dr. G. Béné - 9.2.55.
13. "The Constitution of the Nucleon"
Dr. Y. Goldschmidt-Clermont - 16.2.55.

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DIVISIONAL DIRECTORS REPORTS TO THE COUNCIL

PS DIVISION PROGRESS REPORT

(October 1954 - January 1955)

by J.B. Adams

1. Summary

Detailed work on the many aspects of the PS machine has continued and the results are reported below together with the important parameters on which the design work is now based.

No new objections to the basic principles have been discovered. A new method of achieving alternating focusing and defocusing has been proposed by the Midwestern Universities Research Association in the U.S. but since it seems to offer no simplification or economy for the CERN machine this new idea has not been taken up.

A detailed comparison of the relative state of development of the Brookhaven and CERN PS projects shows that the two groups are still working on the same lines and have reached similar conclusions. The parameters of the two machines are very similar.

The staff in the PS group has been built up from the 50 reported in September 1954 to 75.

Excavations for the PS building on the Meyrin site started at the beginning of February after a long period of surveying the sandstone layers underneath the site to find the most satisfactory position for the magnet ring.

2. Parameters for the Machine

A set of parameters for the PS machine was adopted at the end of December 1954. The more important ones are as follows.

The maximum energy of the machine is 25 GeV and the maximum magnetic field for that energy is 12,000 gauss, these figures being given by the Council in October 1953. The radius of curvature is 70 metres and the mean radius of the machine 100 metres.

There are 50 magnet periods and 100 magnet units in the circumference. The field index n is 282 and the operating mode μ is $\pi/4$. There are 6.25 cycles of betatron oscillation per revolution. The length of the magnet units is 4.4 metres and the field-free gap between the magnet units is 1.6 metres long. There are 10 longer field-free gaps equally spaced around the circumference which are 3.0 metres long. 10 pairs of correcting lenses and 10 pairs of non-linear correcting lenses are equally spaced around the circumference.

The total weight of the magnet iron is 3,200 tons and the weight of the coils if they are made of copper is 220 tons and if they are made of aluminium, 110 tons. The magnetic field rises in one sec. from the injection field of 140 gauss to the maximum field of 12,000 gauss and this cycle repeats every 5 secs. The peak power to energize the magnet is 28 MW and the mean dissipated power 1.5 MW.

It is necessary to give the particles 50 KeV energy gain per turn and it is arranged that 100 KeV per turn is available. There are 32 accelerating cavities, each 2.3 metres long. The harmonic number will be either 20 or 30 and this is yet to be decided. The peak power per cavity is 3 KW and the total weight of ferrite needed is 14 tons. The transition energy is at 5.9 GeV.

The injection energy is still 50 MeV and the injection magnetic field 140 gauss. It is intended to use an Alvarez type linear accelerator for injection whose length is 30 metres. It requires 5 MW of R.F. power to feed this Linac during a pulse of 200 μ sec occurring every 5 secs.

The vacuum chamber is elliptical, in cross-section, 8 x 12 cm. If stainless steel is used for the vacuum chamber, the wall thickness is 1.4 mm; if glass is used the wall thickness is about 7 mm. 40 vacuum stations are equally spaced around the circumference, each using a 10 cm diameter diffusion pump.

Near the injection time the maximum beam cross-section is calculated to be 6 cm high by 10 cm wide assuming the certain tolerances in the construction of the machine. The magnet units have to be aligned to a perfect circle in the radial direction, and the ends of these units are assumed to have a displacement tolerance from the perfect circle of 0.6 mm rms. In the vertical direction, the units have to be aligned to a perfect plane and the ends of the units are assumed to depart from the perfect plane by 0.3 mm rms.

3. Theory

Studies on the motion of particles in non-linear fields have proceeded along the following lines.

The general equations of motion of particles in the vertical and horizontal planes including the natural coupling that exists between the motions in these planes have been set up for A.G. synchrotron. As there exists no analytical solution for these equations perturbation methods have to be used to obtain numerical solutions using digital electronic computing machines. Before the perturbation methods were developed, some runs were made using the A.C.E. computer and a series expansion method. An instability was discovered at a point in the working diamond where the linear theory predicted complete stability. However the non-linearity assumed was very large and by reducing it to more practical values the instability disappeared.

Unfortunately the cost of the computing work is very high. Using the series expansions method and an adequate number of starting conditions, perturbations, working points inside the working diamond, and sizes of non-linearity, it is easy to show that the computing programme would cost about twice the total budget of the PS machine. The theoretical work has been aimed at reducing this cost. For instance, the approximate perturbation method reduces it by a factor 10. The main improvement has come from reducing the number of starting conditions by establishing a few critical conditions that represent possible extreme values. A reduction in the starting conditions and cost by a factor 100 looks possible by this method. The final cost including these reductions is then about 100,000 Swiss francs, which is still high. However intelligent placing of the working points and experience from previous runs might reduce this cost still more.

The high cost of the computing programme stimulated further thought on a mechanical analogue model. This model will simulate motion in two planes in non-linear fields of different orders, acted upon by various types of perturbations. The cost of this model will be small compared with the computing programme and results obtained from using it may be a valuable guide for the computing programme.

Arrangements have also been made to send CERN PS staff to work on the Brookhaven electron analogue model in a few months time.

Relaxation studies are being made to determine the magnetic field pattern to be expected theoretically from Models 5 and 7 magnets. The results will be compared with the experimental results and used for deriving the pole profile to give constant field gradient across the aperture.

4. Magnet

The static measurements on Model 3 (1/3 scale model) and Model 4 (full scale model) have continued and are nearly completed.

Model 5, which is a full scale dynamic model, has been delivered and dynamic tests on this model have started. Model 5 is made from 1 mm thick transformer laminations stuck together by araldite with paper insulation.

Two further models have been ordered, Model 6 which is a dynamic model, made from 1 cm thick laminations with paper insulation, and Model 7 which is identical to Model 5, except that the pole profile is reversed with respect to the yoke. It is intended that Models 5 and 6 will enable us to decide between thin and thick laminations from the technical point of view so that the final solution for the complete magnet can be based on cost.

Investigations on methods to be used for measuring the complete magnet are proceeding along three lines, namely integrator methods with fixed coils, high speed rotating coils methods using air turbine drives and bismuth wire methods using the change of resistance of bismuth wire in a magnetic field.

Methods have been evolved to supply the power for Model 5 using a D.C. generator with a programming system for determining the rise and fall of the current in the magnet. These methods will enable the final current programme for the completed magnet to be specified. From this work the characteristics of the main magnet generator can be determined.

Serious thought has been given to the problem of measuring the 1,000 magnet blocks which form the complete magnet. The programme for measuring these blocks shows that a very tight schedule must be kept in the delivery of the iron and in the various stages of measurement before the final assembly.

5. Engineering

The mechanical design of the magnet units on their trolleys and the jacking arrangements necessary to set them up in the ring building have been completed. A model of a magnet unit trolley and jacks has been ordered. 27 European firms have been approached to see whether they were interested in making the magnet, of which 13 have expressed some interest. Discussions continue with these firms to determine the technical processes preferred by the firms for the construction of the magnet and it is hoped finally to produce a short list from these 13 firms containing only those firms whose designs are technically suitable for the job.

Ten firms have been approached as possible suppliers of the magnet generator and rectifier equipment, of which 4 are technically able to do the job and also interested in doing it. Three of these firms have sent in their proposals for the equipment and these are being studied. No tenders have been asked from these firms.

Detailed plans for the proton synchrotron substations have been worked out in collaboration with Prof. Spieser (Technikum Winterthur), consultant to the architects.

Preliminary plans for the controls system and the cabling of the machine have been made. Trenches and ducts to carry these cables have been provided in the buildings of the PS machine.

Other aspects of the engineering of the proton synchrotron are discussed separately below.

6. R.F. Accelerating System

The design of the accelerating cavity which now is essentially two quarter wave coaxial resonators has reached the mechanical design stage and a full scale model is being planned. The tuning method for the cavities consists of a two pole magnet surrounding the cavity, similar to the stator of an electrical motor. Work on the automatic tuning system continues.

The problem of noise in the R.F. system and its effect on the loss of particles during acceleration has been studied in detail.

Similar studies have been made on non-adiabatic frequency errors in the R.F. voltage applied to the accelerated particles.

7. Injection Linac

Serious consideration has been given to using the 50 MeV Linac design first invented by Alvarez and more recently developed by Harwell. Protons are accelerated to 500 KeV by a cascade generator and then accelerated to 10 MeV in the first tank of the Linac. Acceleration from 10 to 30 MeV and from 30 to 50 MeV is provided in the next two tanks. The Division has inquired if the firm of Metropolitan Vickers in England could manufacture the three tanks of the Linac together with the vacuum system. This firm is already manufacturing the Harwell Linac. They are willing to undertake the work and views on contract terms have been exchanged. The Finance Committee have been consulted on this matter.

The 500 KeV set has been ordered from Haefely, Switzerland, as a result of competitive tenders.

Work on the ion source has continued at Karlsruhe and will be transferred to Geneva shortly.

Experiments on commercial R.F. amplifying valves continue but no decision has yet been made on the type to be finally used as the power source for the Linac tank. The firms capable of making these valves in Europe are Siemens (Berlin), Telefunken (Ulm) and the French firm Thompson-Houston. Another alternative is the Eimac (USA) tubes.

The first order theory of the inflector system has been carried out and experimental studies are now being made to find the effect of aberrations in the system.

The design of the buncher and debuncher has been completed theoretically and space is provided in the Linac design so that they can be added later on.

8. Site Surveying

As a result of many boreholes dug in the area proposed for the PS machine on the site at Meyrin, it has been possible to construct a complete map of the sandstone layers underneath the covering moraine layers in this area. As a result of this work it has been possible to find a satisfactory position for the PS machine on the site. It has been necessary to ask for extra ground to be made available on the south border of the site but it appears that there is no difficulty in obtaining this ground.

Prof. Bonnard (Laboratoire de Géotechnique de l'Ecole Polytechnique de l'Université de Lausanne) has acted as consultant for the geological work on the site. Prof. Schnitter (ETH, Zurich) has been consulted about the soil mechanics and the foundation arrangements for the magnet. Survey markers have been set up on the site in the moraine layer and accurate surveys are being started to measure the ground movements. Further markers are being set up to measure the relative movement of the moraine and the underlying sandstone rock.

9. Buildings

The main buildings for the PS machine have been designed by the architects in collaboration with the PS Division and excavations for the main complex will start in February.

The magnet now sits on a separate foundation with pillars going down into the sandstone layer underneath and the ring building is a separate shell that carries the moraine layers but does not transmit this load to the magnet foundations.

It is planned to build an experimental section of the ring building and the magnet foundation on the site so that experiments can be carried out to determine ground movements, concrete shrinkage and the technical difficulties of constructing such a building. It is hoped that this trial section will be completed during April.

10. Laboratories at the Institute of Physics

Four barracks and the annex of the Institute of Physics are occupied by the PS staff. A well equipped workshop with 10 mechanics has been set up and is providing good support for the experimentalists. A drawing office, fully equipped, with a staff of 8 draughtsmen and 2 senior design engineers is engaged in detailed designs for the PS machine. An electronic workshop with four technicians gives support to the laboratory staff.

Two more barracks have been ordered, one as an extension to the workshop and for a glassblowing shop, the other for more offices and laboratories and an extension to the drawing office.

11. Comparison with Brookhaven

Dr. Hine of the PS Division recently visited Brookhaven to get a direct exchange of views on our two projects. The work of the two groups follows the same general lines and has reached a similar state of development. There are however some differences of emphasis which are worth noting.

The Linac group of the CERN-PS started out with two possibilities for the Linac structure, the helix scheme and the Alvarez scheme. It turned out that the helix idea was less attractive than the well tried Alvarez scheme and was dropped for that reason. The Brookhaven group have developed an interdigital structure as an alternative to the Alvarez structure and at the present stage of development they find that it shows definite advantages over the Alvarez design. More studies are needed before they make a choice between the two designs but there seems a definite preference for the new design. This new development is being considered by the CERN-PS Linac group.

The buildings for the machine at Brookhaven are in general similar in principle to ours although less developed architecturally. A useful criticism of our lay-out, made by Brookhaven, was that only one beam could be used from the main target at any one time. This is the forward going beam. As it is easy to meet this criticism by small alterations to our lay-out, these alterations will be made, although some extra cost is involved. The estimated cost of the Brookhaven building is higher than ours.

The electron analogue model is nearing completion and we expect to send over two PS members to work on this model during April 1955.

The Brookhaven group have not discovered any new major objection to the principle of alternating gradient synchrotrons and they are proceeding to develop the detailed design with the same wary enthusiasm as the CERN-PS Division. The detailed design of the two machines is very similar indeed. Rough estimates for the total cost of the Brookhaven machine are higher than ours.

DIVISIONAL DIRECTORS REPORTS TO THE COUNCIL

SC DIVISION PROGRESS REPORT

(15 Sept. 1954 - 15 Feb. 1955)

by C.J. Bakker

1. Staff.

In this period, the members of the Division moved gradually to Geneva.

The Division has 10 full-time members in Geneva where Ir. Krienen acts as their teamleader.

One member is stationed in Eindhoven.

The Division Director stationed in Amsterdam, works on a half-time basis.

Nine consultants co-operate with the Division.

Two meetings of the SC were held in Geneva during this period.

At Cointrin, the SC Division has at its disposal one small barrack with 4 offices and three offices in the hangar.

The temporary workshop shared with the STS Division is also situated in the hangar.

It is envisaged that the staff of the SC Division will be 25 by the end of 1955.

2. Construction of the Synchro-cyclotron.

The construction of the 600 MeV Synchro-cyclotron progresses satisfactorily.

Since October 6, orders for two big parts of the machine (the magnet frame and the coils) and for the machine in the temporary workshop at Cointrin have been sent out. Invitations for tendering on other parts of the SC have been prepared and orders will be placed shortly.

3. General lay-out and building.

The SC building is under construction at the site at Meyrin. The foundation has been completed. The co-operation between the SC and SB divisions has proved to be very fruitful. The building will be ready to receive the first blocks of the magnet frame not later than October 15, 1955. A time schedule for the construction of the SC is attached to this report.

4. The magnet.

The magnet frame has been ordered from Schneider-Creusot in France. The first forgings have been made. On January 11, 1955 a first discussion was held at Geneva with the staff of Schneider-Creusot. Regular meetings during the manufacturing of the magnet frame are foreseen.

The coils of the magnet have been ordered from ACEC in Belgium. Close contact between ACEC and the SC Division is kept.

The 1/10 scale model built in Uppsala is now in Geneva and will be put into operation again. A motor generator set for engineering the coils of this model magnet has been ordered.

5. Vacuum chamber and pumping lay-out.

The design has been frozen. The ordering will take place in accordance with the time schedule.

6. The high frequency system.

Development work at the Philips works in Eindhoven (Holland) is not yet finished. Measurements on the h f. system with the aid of a vacuum test bench are under way. The work in the Philips Physical Laboratory on the tuning forks of reduced scale is nearly completed and shows very promising results.

The true size tuning forks have been ordered and will be available for testing purposes in May 1955.

7. The control system.

The design of the control elements is ready.

Invitations for tendering have been sent out. Much work has still to be done on the final composition of the control system.

8. Power supply.

The power installation for the SC has been ordered. The lining up of the various items is in a design stage.

9. Previous Progress Reports.

CERN/SC 19, Annex III/II in Minutes of the 3rd session at Amsterdam, CERN/GEN/4.

CERN/SC 35, Annex V/II in Minutes of the 4th session at Brussels, CERN/GEN/6.

Pages 14-16, in Second Report to Member States, CERN/GEN/5.

CERN/SC 65, Annex V/II in Minutes of the 6th session in Paris, CERN/GEN/10.

CERN/SC 81, Annex IV/II in the Minutes of the 7th session in Geneva, CERN/GEN/12.

CERN/SC 93, Annex V/II in the Draft Minutes of the 8th session in Geneva, CERN/79.

CERN/SC 101, Annex V/II in the Draft Minutes of the 9th session in Geneva, CERN/92.

DIVISIONAL DIRECTORS REPORTS TO THE COUNCIL

STS DIVISION PROGRESS REPORT

(1 Oct. 1954 - 31 Jan. 1955)

by L. Kowarski

Two of the proposed Sections are being developed at present :

A. Instrumentation.

B. Information.

A. Instrumentation Activities1. Electronics.

A workshop has been equipped with measuring equipment, tools and components; the physicist in charge (Dr. G. von Dardel) had the assistance of one technician and three more will arrive in the near future. The recruitment of at least one graduate engineer for circuit development is being arranged for. The production of a slow pulse analyser for the testing of other equipment is in progress.

It is too early to see in what proportion the electronic equipment to be used for the scientific work will be available commercially or will have to be manufactured (either by outside firms under CERN supervision, or in CERN's own workshop). High standards of reliability will have to be evolved and insisted upon in all three cases. Experience of various types of commercially-made equipment is being acquired, in contact with the electronic divisions in Harwell and in Saclay, where the problems are similar.

Standardization and other topics of common interest are discussed with members of the PS group in contacts which take place on a regular schedule (SC to join presently).

2. Mechanical workshop.

The provisional workshop operated at Cointrin jointly by the SC and STS Divisions is nearing the completion of its installation period. All the essential machines and minor equipment have been purchased; most of these items have already been delivered.

3. Leak detectors.

The advisability of developing a portable leak detector which could also be used by the accelerator groups is being studied.

4. Development of cloud chambers and bubble chambers.

A committee was appointed in September to study the development of Wilson chambers in relation with basic research and instrumentation. After two months of work, involving numerous contacts between its members and one plenary session, the Committee submitted to the Director-General a Report in which the following recommendations were made :

- a) The initial efforts should be centered on a definite experiment (see below);
- b) These efforts should however be organized with a view to a subsequent expansion of the cloud chamber development along several directions. At an early date, one or several experimental chambers should be built in order to study the possible improvements (fast recompression, high clearing fields, facilities for ionisation measurements, etc). These chambers would serve as models for the design of instruments to be used with the synchrocyclotron;
- c) The technique of large chambers with high magnetic fields should be studied with a view to a study of the heavy unstable particles produced by the proton synchrotron. The Report contains a discussion of the general design of such a chamber, with a field pulsed in synchronism with the PS, and considers the possibility and the advisability of producing a single instrument responding at will to cosmic rays or to artificial beams;
- d) Initial exploration of the bubble technique should take place as soon as practicable.

Since the issue of this Report, material work on the immediate programme has begun. Other items are in the discussion stage. Several suggestions put forward in the course of these discussions (e.g. use of memory circuits in counting; semi-continuous bubble process; production of high fields in large volumes) were found to be under active consideration in American laboratories, as seen by Dr. Goldschmidt-Clermont on the occasion of his participation in the Rochester Conference.

5. Immediate experimental programme.

In order to gain experience in the instrumentation field before the accelerators are working, two cloud chambers and fast electronic circuits are being constructed and will be tested in an experiment on K-mesons, described in DG/Memo/3 (Nov. 1954).

Work on the detailed design of the cloud chambers and their production in the workshop is now in progress. They will be of the same general type as the multiplate chamber used at the Pic du Midi, although of much larger dimensions.

The electronic part of the experiment involves large scintillation Cerenkov counters with associated amplifiers, coincidence circuits and a fast oscilloscope for recording the timedelays and pulseheights. Most of this equipment could be bought commercially, and is already on hand or expected to arrive shortly. Items non-available commercially will be produced by the STS electronic workshop.

Design of the control circuits for the cloud chambers is in progress. A very versatile control system is envisaged so that the performance of the chamber and its dependence on the various parameters can be studied systematically. This study will prove useful for the future programme of cloud chambers for the machines.

6. Personnel as of January 31st.

Two L3, one L4, three T3, one T4, one Anc; one consultant (Prof. C. Peyrou).

Further recruitment is in progress.

B. Information Activities

1. Library.

A standard system for ordering books and periodicals has been introduced. Favourable purchase terms have been arranged, in most cases with booksellers in countries of publication.

A code of cataloguing rules, devised to meet the special needs of CERN (two languages, frequent handling of reports, etc.) was worked out and put into operation. Complete duplicate catalogues are maintained at the two present locations (Cointrin, Institut de Physique) and cards for all accessions are distributed to the members of the scientific and technical staff. A subject catalogue is being built up retrospectively. The library receives about 100 titles of periodicals and serials which have been selected on the basis of a questionnaire circulated among the staff.

Arrangements for the borrowing of books and periodicals and for photocopying, already in force with the Zurich Polytechnic, have been extended to Paris, London and New York.

A Library Committee has been appointed by the Group of Directors; it has met twice and established policy on such matters as : divisional libraries, selection of books and periodicals, selection of cases where several copies should be purchased, handling of reports and reprints.

2. Publications and Exchanges.

A complete set (in quadruplicate) of all technical reports and notes, which have been issued and circulated under CERN's aegis since its inception, is being assembled and catalogued. When this task is completed, lists of material available for distribution will be circulated.

In addition to exchange with institutions specialized in the nuclear field, library deposits of CERN reports have been arranged at Harwell and the Science Museum and it is hoped that similar arrangements with other Member States will be arrived at.

The guiding principles for the publication of CERN reports have been adopted after an extensive discussion with the interested Divisions. The publication of the main series (reports of a permanent character and reprints) has begun in January 1955.

Memoranda of a less permanent character will be duplicated and distributed by the Division concerned. The information Service will centralise and supervise their exchange distribution.

3. Copying and Photography.

The Service is now equipped for duplicating and photographing activities including :

- rapid copying : "lumoprint" for one or two copies; heliography up to 50 copies;
- off-set printing : the "Multilith" machine is used for the printing of reports for line drawings and half-tones and to replace stencil duplication where a large number of copies is needed;
- photography : technical photography, photographic records and press photography.

4. Press relations.

Press conferences were held in October and November. A comprehensive series of press releases (9 to date) was prepared and distributed to the local journalists, press agencies and technical journals in Member States. The United Nations Press Room has been placed at the disposal of CERN. As a rule, journalists are invited to submit their pieces to revision before publication; this practice is now being followed with increasing regularity.

5. Official visits have been made to the following institutions :

- In GENEVA - U.N. Library, U.N. Department of Information. W.H.O., International Organization for Standardisation, Battelle.
- In PARIS - Centre National de la Recherche Scientifique, Commissariat à l'Energie Atomique, Unesco.
- In BRITAIN - Harwell, Department of Scientific and Industrial Research.

6. Personnel as of January 31st.:

2 graduates (one of which half time); five subordinates.

DIVISIONAL DIRECTORS REPORTS TO THE COUNCIL

SB DIVISION PROGRESS REPORT

(9 Oct. 1954 - 31 Jan. 1955)

by P. Preiswerk

Under the interim organization of CERN, the Laboratory Group was entrusted, among other tasks, with the planning of the site and the building of the future laboratory. Already towards the end of the interim period the transition to the construction period took place. Preliminary construction work started (such as roads, drainage, canalisation, excavation of the pitch of the SC building).

The newly created division took over staff from the former Laboratory Group. It will be increased by a few new appointments. The contract with the chief architect, Dr. Steiger, was transferred to the new Organization.

The final plans of the SC building were enough advanced that, after the approval by the Council in its first session, the contract for the super-structure of the building could be immediately placed. The most urgent part of the foundations of the building could be finished before the end of December, when the winter season began and caused some interruption of the work on the site. The programme of construction was drawn up to be timed in accordance with the requirements of the SC division whose claim it is that the erection of the magnet should start next fall. Orders for the steel construction for the halls of the SC building, cranes and lifting devices have been placed and tenders for other items (electrical, heating installations, etc.) will be sent out next month. Baryte for the construction of the shielding walls is arriving regularly from the South of France. Until now 1300 tons are stored on the site.

The lay-out of the PS building has been fixed during the last month and it is now a sufficiently definitive basis for the elaboration of the detailed construction plans by the architect. The implantation of the building on the site was particularly studied and the exact position of the building has recently been decided. From the results of the

investigations of the ground, the conclusion was drawn that a shift of the building south west relative to the previous position (see for instance drawing 097, 4.10.54) would be of advantage. This shifting implicates that part of the annex building and shielding boards will be lying over the actual boarder of the site. The Geneva Authorities have been asked for a possibility of an extension of the site and they have shown very great comprehension and decided to purchase a strip of land of 50 x 300 sq.m. annex to the boarder and add it to CERN's site. The excavation for the experimental hall has been ordered. This part of the building is the most urgently needed by the PS division and the excavation work will start in February. As regards the ring building, a model of a section (scale 1 : 1) will be built in order to undertake different measurements on the behaviour of the soil and the foundations (for instance the deformation of the sub-soil molasse under the load of the foundations and the shielding) and to study some aspects of the construction process in practice. Professor Schnitter of the ETH and Professor Bonnard of EPUL have been asked for expert advice.

The beginning of the construction of the other buildings is also foreseen for this year. The lay-out of the workshop and power house is determined as well as that of the laboratory wings. During the elaboration of the plans a simpler solution for the construction was adopted. The size of the room units has been somewhat reduced relative to the previous plans. Studies of the part of the building which will shelter administration, the library, the conference room, and the canteen etc. continue.

As regards labour on the site, the cantonal authorities consented not to apply the Swiss and cantonal restrictions relative to the employment of non-Swiss labour during the winter months. On January 31, the number of workmen on the site was 91. The largest number coming from the neighbourhood in France.

Electricity supply is at disposal on the site. A provisional transformer station was erected and connected to the main supply in town. A provisional contract for the supply of electricity during the construction period was signed with the Services industriels. A final contract is still under discussion.

Drinking water and gas were brought to the site and it is hoped that the Services industriels will have the installations for bringing cooling water to the site, ready by April 1956.

DIVISIONAL DIRECTORS REPORT TO THE COUNCIL

THEORETICAL STUDY DIVISION'S PROGRESS REPORT

(September 1st, 1954 - January 31st, 1955)

by C. Møller

1. The Division has continued its work along the same lines as during the period of CERN I, outlined in the Progress Report presented to the Council on the Organization's first session, October 7th-8th, 1954.
2. As mentioned on that occasion, C. Møller has taken over the duties of the Divisional Director. He has been assisted, from October 1st, 1954, by S. Rozental, and from January 1st, also by A. Bohr, as Assistant Directors. All three are appointed on 60% part-time basis. To take part in the loading of the scientific work the Division has secured the co-operation of G. Källén and B.R. Mottelson who have joined the Division on full-time basis as Senior Staff Members.
3. On February 1st the Division will for the first time since the beginning of its activities in 1952 have Junior Members from all CERN countries, viz.:
 - K. Alder (Switzerland)
 - E.R. Caianiello (Italy) (on Febr. 1st succeeding M. Cini)
 - M. Demeur (Belgium)
 - A.R. Edmonds (Great Britain)
 - I. Espe (Norway)
 - St. Fallieros (Greece)
 - P. Kristenson (Denmark)
 - B. Nagel (Sweden (on Jan. 1st, succeeding S.G. Nilsson)
 - B.R.A. Nijboer (Netherlands)
 - V. Roglic (Yugoslavia)
 - H. Steinwedel (Germany)
 - A. Visconti (France)
 - S.A. Wouthuysen (Netherlands)
4. During the period the Division has had visits for discussions by:
 - W. Fowler (U.S.A.)
 - D. Pines (U.S.A.)
 - H.A. Tolhoek (Netherlands)
 - L. Rosenfeld (Great Britain)
 - V.F. Weisskopf (U.S.A.)

5. The co-operation with European laboratories has been maintained and developed. The appointments of G. v. Giorke and D. Harting in the Nuclear Research Laboratory of the University of Liverpool were prolonged for one year, and from October 1954 G. Fidecaro from Italy and R. Moch from France have joined the Liverpool team. Unfortunately, R. Moch was obliged, for personal reasons, to go back to Paris already on December 31st, and inquiries have been sent out to Member States asking them to propose another young physicist to take the vacant place.

In Uppsala, A. Lovati and A. Pappas continued their work, the latter on half-time basis with a younger assistant.

6. In continuation of the lists contained in the previous Progress Reports, the attached Appendix gives the titles of lectures and colloquia held during the period covered by this report as well as a list of publications and preprints.

A P P E N D I X

List of lectures and Colloquia

A. Mesons and the Field Theory of Nuclear Forces

- C. Møller: Weekly lectures on "The general S-matrix theory".
- P. Kristenson: Weekly lectures on "Introduction to Relativistic Quantum Field Theory".
- L. Rosenfeld (October 1): Proton-proton scattering.
- R. Cutkowsky (October 11-13): The Bethe-Salpeter equation.
- M. Cini (November 1): Pion nucleon scattering by variational methods.
- G. Källén (November 3): Scalar and longitudinal photons and the gauge invariance of quantum electrodynamics.
- G. Källén (November 15): A field theoretical model suggested by T.D. Lee.
- J.C. Swihart (December 6): Conservation of isotopic spin and isotopic gauge invariance.
- M. Cini (January 28): Informal discussion on non-adiabatic effects in non-relativistic bound states.

B. Quantum Electrodynamics

- L. Rosenfeld (September 22): Mass differences between neutral and charged particles.
- E. Lomon (October 25): The non-electromagnetic neutron proton mass difference.
- V.F. Weisskopf (November 22): Proton-neutron mass difference.
- S. Ozaki (December 18): On Källén's argument concerning longitudinal and scalar photons and gauge invariance in quantum electro-dynamics.
- A. Sabry (January 18): Fourth order vacuum polarization.

C. Nuclear Constitution

- L. Rosenfeld (September 24): The α -particle model.
- L. Rosenfeld (September 27): On scattering of fast electrons by nuclei.
- H.A. Tolhoek (September 29): On the formulation of the nuclear collective motion.
- D. Frisch (October 8): Proton-proton scattering.
- B.R. Mottelson (October 15): Nuclear rotational states.
- D. Pines (October 19): The Nucleon dipole resonance.
- A. Winther (November 12): Coulomb excitation.
- K. Alder (November 19): Coulomb excitation.
- V.F. Weisskopf (November 22): Nuclear rotational states.
- T. Huus (December 3): Experiments on coulomb excitation.
- P.O. Fröman (December 10): Alpha decay of deformed nuclei.
- H. Steinwedel (December 20): Transformation to rotating co-ordinate system.

Weekly informal discussions on problems of nuclear constitution.

D. General Topics

- D. Pines (October 18): Electron theory of metals.
- L. Wilts (October 27): Derivation of the Maxwell Lorenz equation from special relativity and Gauss' law.

- D. Frisch (October 29): Scattering of light by nuclei.
H. Steinwedel (November 8): A new mass spectrometre without magnetic field.
T. Huus (November 26): Delta-rays from bombarded targets.
W. Fowler (January 17): Nuclear reaction in stars.

Publications and Proprints

- K. Alder and A. Winther: Theory of Coulomb Excitation.
(conf. CERN/T/Rep. - 8, Appendix)
Phys.Rev. 96, no. 1 237, 1954.
- L.L. Foldy and E. Eriksen: Some physical consequences of vacuum polarization. (Conf. CERN/T/Rep. -8, Appendix)
Phys.Rev. 95, no. 4 1048, 1954.
- P.O. Fröman: A simple derivation of a general equilibrium equation with two astrophysical applications.
(conf. CERN/T/Rep. -8, Appendix).
Arkiv för Fysik 8, nr. 16 - 1954.
- R. Haag: On quantum field theories.
In print (Dan.Mat.Fys. Medd.)
- N.M. Hugenholtz: Variational principle in quantum mechanics.
(conf. CERN/T/Rep. -8, Appendix)
Phys.Rev., 96, no. 4. 1158, 1954.
- Z. Janković: A contribution to the theory of nuclei with a diffuse surface.
To be published in Philos. Mag.
- S.G. Nilsson: Particle states for strongly deformed nuclei.
To be published in Dan.Mat.Fys.Medd.

Preprints

CERN/T/KA-AW-1: K. Alder and A. Winther: Numerical data on electromagnetic excitations.

CERN/T/A-B-H-M-W-Z-1: K. Alder, A. Bohr, T. Huus, B. Mottelson, A. Winther and C. Zupančič: Preliminary draft of a table to appear in a review of the Coulomb excitation reaction.

In preparation

Lecture notes by C. Møller on "The general S-matrix theory".

Lecture notes by P. Kristensen on "Relativistic quantum field theory".

DIVISIONAL DIRECTORS REPORTS TO THE COUNCIL

ADMINISTRATION DIVISION PROGRESS REPORT

(15 Oct. 1954 - 15 Feb. 1955)

by S.A.ff. Dakin

The Administration Division came into existence with the appointment of the Director of Administration on the 1st of October, 1954, and with the decision of first meeting of Council about the organization of CERN. But the Division did not start its work from nothing. Many of the essential staff were in post and much preparatory work had been done by them under the direction of Dr. Kowarski. The Administration Division proper has therefore had to work towards the completion of a structure whose foundation and a great part of those upper works were already entirely prepared by its forerunners.

Most of the work of the Division since October is reflected in papers which are before the Council : if these papers meet with approval a great part of the administrative machinery will be in operation.

Personnel Office.

During the period, Personnel Office has been able to take over the responsibility for organizing the recruitment of staff and is now working a procedure (described in CERN/118) which consists essentially of the use for all normal purposes of competitive recruitment boards, working as far as possible to implement a forward programme of posts to be filled.

Intake continues to be generally satisfactory and has kept pace with the anticipated divisional requirements. The total strength of the Organization at the 1st of February was 180 of which 156 were stationed in Geneva. The distribution of staff at this date is given at Table I. The number of applications for employment with CERN now amounts to 3,500.

CERN STAFF AS AT 1st FEBRUARY, 1955

Table I

Distribution by Functions and Divisions

Division	S t a f f					
	Leading and Scientific	Technical	Adminis- trative	Ancillary	Stipend	Consul- tant
Dir.-Gen.	7 (2)		3			
P.S.	28	36	5	4 1/2		2
S.C.	7	3	1			8
S.T.S.	6 (1)	8	2	1		1
S.B.	1	2	1			
THEORY	5 (3)		1	(1)	17 (1)	
ADMIN.	3		27	10 1/2		
TOTAL	57 (6)	49	40	17 (1)	17 (1)	111
Total Staff exclu- ding Consultants						180 (8)

Note : The numbers in brackets indicate part-time staff, and are included in the totals.

The Social Insurance Schemes are now in full operation.

In December and January, a careful review of all the staff was carried out by a board under the Director-General as a result of which it was possible to agree on universally acceptable ratings for the staff and as result to issue the first long-term contracts of employment by the end of January.

The Staff Regulations and Rules were reviewed and have now reached a form which, it is hoped, will serve the Organization for some time with little further amendment.

Personnel Office has during this period made progress with the organization of various office and staff services, as for instance, a small transport pool, a messenger service within Cointrin and between Cointrin and the Institut de Physique, a post-room and registry, the typing and duplicating pool, a very small welfare section and first-aid arrangements. It has also established good working relations with the local and federal authorities.

Finance Office.

The Finance Office has been principally concerned with two main jobs, namely, the production, scrutiny and presentation of the Budget for 1955, and the task of taking over financial operations from the Divisions and of bringing past financial operations to account in a common form. The finance of all Divisions, except P.S. were brought into Finance Office before the end of 1954, and that of the P.S. from the 1st January, and all payments are now made from Finance Office under proper control, automatically booked and subjected to internal audit.

As a result all the subsidiary banking accounts except that in Copenhagen have been closed. At present the staff is considerably over-worked but it is hoped that once the back-log of clearing up the past has been got rid of, the system devised will, without strain be able to handle the operations of the Divisions with a minimum delay, to ensure that all operations are properly controlled and recorded and to produce at very short notice a complete statement for expenditure, receipts and of the whole financial positions.

During the period the Financial Rules have been carefully revised and approved by the Finance Committee.

Preparations for the institution of an Inventory of all CERN assets are now nearly completed. A clear system for the delegation, where necessary, of the Director-General's approval and signature in financial matters, has been worked out and is now in operation.

A complete statement of the Financial position comprising provisional accounts up to the end of 1954, a balance at that date, a statement of contribution paid, appears on separate papers CERN/FC/34 and 35.

Purchasing Office.

During the period the Purchasing Office has been doing all the purchasing for the SC, STS, Admin. Divisions and for the Directorate. It has been co-operating in the production and the adjudication of tenders placed by the Architect and the Site and Buildings Division, and has advised the PS Division on a number of cases. It is expected that in the near future the Purchasing Office will take over all purchasing for the PS Division, probably through an officer out-posted there.

For the period October 1st, 1954 - January 31st, 1955, the Purchasing Office placed 552 orders (including contracts) for a total amount of

Sw.Fr. 5.068.795,--

Out of these 552 orders, the following 3 were in excess of Sw.Fr. 50.000 each.

S.C. Magnet frame	3.926.000,--
S.C. Magnet coil	497.500,--
STS/SG Milling machine	53.761,--

representing together a total of

Sw.Fr. 4.477.261,--

A paper outlining the procedure which will be followed for purchasing has been approved by Finance Committee. A contract for the Linear Accelerator for PS is under negotiation with suppliers.

Foreign Relations.

The Headquarters Agreement with the Swiss Federal Council has been further negotiated with Swiss representatives and is now, it is hoped, ready for signature. Many particular subjects have been discussed with the Authorities of Geneva and with the Federal Authorities, who have always shown themselves most understanding of the special needs of CERN. An Agreement covering the occupancy of the site at Meyrin is under negotiation with the Geneva Authorities.

A draft Agreement including possible clauses covering immunities and privileges to CERN has been presented to Member States.

Rules of Procedure for Council have been carefully revised and are now ready for the Council.

General.

The Director of Administration and his staff have helped to prepare and have been present at two meetings of the Finance Committee and two meetings of the Finance Committee Working Party, and one of the Committee of Council.

An eminent Geneva lawyer has been retained as Legal Adviser to CERN.

A Committee comprising representatives of Administration and of the staff has been set up to consider the problem of staff housing and to make recommendations to the Director-General.

A policy on the handling of patents is being worked out.

A Staff Association is in course of formation and besides the services which it will offer to the staff, will, it is expected, be of great assistance to the Administration in the handling of problems which affect the life and conditions of the staff.

The staff of Administration is at present forty and appears to be very nearly complete. With the filling of only a few more posts the Division should be fully equipped to deal with the heaviest steady work load which the future is likely to bring.

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