CERN COURIER

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EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

The European Organization for Nuclear Research (CERN) came into being in 1954 as a co-operative enterprise among European governments in order to regain a first-rank position in nuclear science. At present it is supported by 13 Member States, with contributions according to their national revenues: Austria (1.92 %), Belgium (3.78), Denmark (2.05), Federal Republic of Germany (22.47), France (18.34), Greece (0.60), Italy (10.65), Netherlands (3.87), Norway (1.46), Spain (3.36), Sweden (4.18), Switzerland (3.15), United Kingdom (24.17).
Contributions for 1963 total 92.5 million Swiss francs.

The character and aims of the Organization are defined in its Convention as follows

'The Organization shall provide for collaboration among European States in nuclear research of a pure scientific and fundamental character, and in research essentially related thereto. The Organization shall have no concern with work for military requirements and the results of its experimental and theoretical work shall be published or otherwise made generally available.'

Last month at CERN

An important event at the session of **CERN Council,** held on 19 December, was the approval of the budget of 94.2 million Swiss francs for 1963. This sum represents an increase of 13 % over the figure for 1962, and reflects the recognition by the Governments of CERN's Member states of the need for continued expansion during the next few years. A report of the Council session begins on p. 9 of this issue.

Contents

The cover picture shows both the beginning of the current bad weather and a look towards the future. Soon after the announcement that an adjoining area of land had been offered to CERN by the French Government (see this page and p. 10), work had already begun on testing the soil and rock conditions.

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CERN COURIER

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The proton synchrotron and the synchro-cyclotron were in operation during most of December, although both accelerators were shut down over the Christmas and New Year holiday. At the **proton synchrotron,** apart from various counter and spark-chamber experiments, three big track chambers were in action. The Saclay/École Polytechnique 81-cm hydrogen bubble chamber concluded its successful run with kaons in the North hall, the CERN/E.T.H. Wilson cloud chamber, also in the North hall, continued its study of neutral particles from pion-proton interactions, and the CERN 1-m heavy-liquid bubble chamber completed its tests with various particles in preparation for the neutrino experiments. The average intensity of the circulating proton beam was considerably higher than in November, and the highest average for a complete 8-hour shift reached 5.8 x 10^{11} protons/pulse. A day was cut from the second operating period of the month, and the machine was shut down from Saturday morning, 22 December, until 3 January.

At the **synchro-cyclotron** two major counter experiments, running in parallel on different pion beams, were brought to preliminary conclusions, while several groups tested beams and equipment for new projects. The machine ended the year with a record internal current of 1.8 microamps, which is six times the intensity obtained at the beginning of 1961.

On the night of 16-17 December, operations at the PS were interrupted when a severe **storm** blew off some 100 m² of the asbestos roofing on the South experimental hall. Machine operators and physicists joined the 'pompiers' in hastily covering up equipment to protect it from the incoming water. Altogether some 450 m² of roofing sheets had to be replaced. Other damage that night included the loss of some 15 m of guttering from the NPA building, parts of the roof trim of the main workshop, and shutters from some of the barracks.

In the **Data Handling Division,** an IBM 1401 computer was installed on 3 December as peripheral equipment for the 709, replacing both the punched-card-to-magnetic-tape converter and the magnetic-tape printer. One of the main functions of the new computer is to perform more quickly the operations of the equipment it replaces, ensuring that almost all the input and output of information to and from the 709 can be performed at the highest possible speed on magnetic tapes.

The 1401 can transfer information approximately four times as fast as the old equipment, both from cards to magnetic tape and from magnetic tape to print, which more than compensates for the fact that it is no longer possible to perform these operations simultaneously. The computer can also be used for such things as listing cards, copying magnetic tapes, and punching cards from magnetic tape. As all these operations are under programme control, there is greater flexibility than would be possible using simple, single-purpose machines. Moreover, as the 1401 is itself a computer, it may prove to have other uses that will lead to a saving of time on the 709. Finally, it costs CERN rather less to hire than the equipment it replaces ●

A Directorate Member for Technical Management

An announcement after the 23rd session of Council on 19 December gave the news that Dr. **Pierre Germain** had been appointed as part-time member of the CERN Directorate. He will be responsible for technical management.

The new Directorate member was born in Brussels in 1922, and has been at CERN since August 1955. In 1960 he became leader of the Proton Synchrotron Machine Group (now the MPS Division), a post which he still holds.

Dr. Germain was the subject of 'Who's who in CERN' in CERN COURIER, vol. 2, no. 3, last March.

CERN in 1962

The beginning of a new year is always a favourable time to review the achievements of the past twelve months, and this year it is particularly appropriate to do so for CERN. Not only was the Organization seen to emerge as a leader in the search for understanding of sub-nuclear particles, but also any doubts about its future were largely cleared away. The Governments of its Member states agreed on the necessity to finance increased growth, and a firmer basis for forward planning was instituted. At the end of the year, plans were announced for a probable expansion of the site over the border into French territory (see p. 10).

As an opening to our account of the past year's progress we are reprinting the introduction contributed by the Director-general, Prof. V.F. Weisskopf, to the Division Leaders' reports presented at the twenty-third session of the Council in December. The account itself consists largely of summaries of, or extracts from, these reports and, although nearly all the headings correspond to the names of CERN Divisions, the intention has been to present the progress and achievements of the Organization as a whole. A great deal of work not specifically mentioned here has, of course, been carried out by a great many people.

REVIEW BY THE DIRECTOR-GENERAL

The year 1962 was a decisive year for CERN. The time spent on getting accustomed to work with a huge machine was over, and the haphazard and timid approach, which characterized the beginning of our research work, is now replaced by a healthy and serious scientific programme which exploits reasonably well the opportunities of the two accelerators within the framework of our present state of development.

It is by no means yet a full exploitation of our facilities. This will have to wait until we receive sufficient financial support for the construction of the necessary installations with which one can make use of all the research possibilities offered by our present machines.

An important event during this year was the Eleventh international conference on high-energy physics, which took place at CERN in July. These conferences, held now every two years, gather the leading physicists in this field of research from all over the world ; they report and discuss the relevance of their latest discoveries.

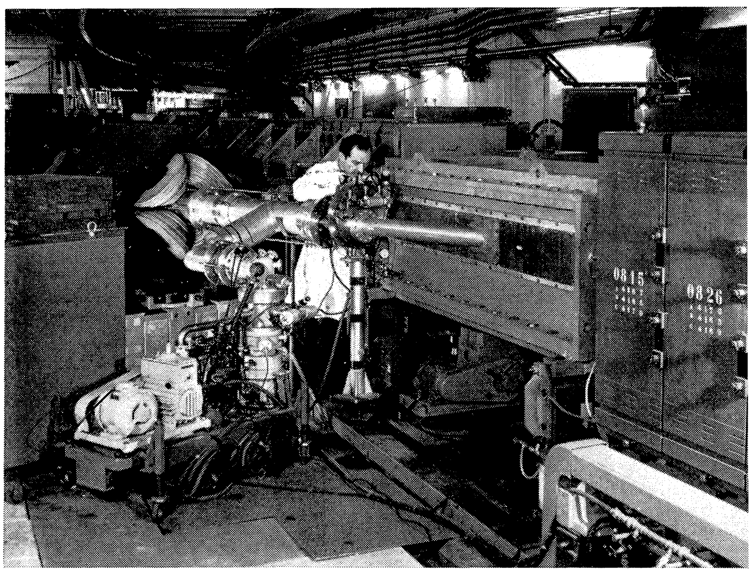
Two facts emerged from this conference : first, high-energy physics is now entering one of its most interesting periods ; a wealth of new discoveries is to be expected soon which will answer some outstanding fundamental questions. Secondly, CERN emerged for the first time as one of the leading institutions in this field. Such a meeting provides an excellent opportunity to compare the work of different laboratories. It was clear to everyone that CERN came out very well in this comparison. The achievements of CERN are, in fact, achievements of scientists all over Europe, since large parts of our experiments are studied and evaluated in European laboratories other than CERN.

Three lines of research seem to be at the centre of interest today :

(a) the scattering of elementary particles at high energies ;
(b) the investigation of higher quantum states in nucleons and bosons ; the emergence of a new 'spectroscopy' in this field ;
(c) the study of weak-interaction phenomena ; effects connected with neutrinos and heavy electrons.

In all three lines, CERN, in collaboration with other research centres in Europe, was able to contribute important results. In the first one, it was at CERN that the so-called shrinking of the diffraction pattern at high energies was discovered, a new phenomenon of first importance for the structure of elementary particles. In the second one, a number of new quantum states were thoroughly investigated and, in particular, their production by matter-antimatter annihilation was investigated at CERN. In the third line of research, the conference was impressed by the announcement of the discovery made at Brookhaven of two kinds of neutrinos ; an experiment which was attempted at CERN in 1961, but without success. However, CERN has contributed other important facts to the same topic, such as a measurement of the radioactive decay of the pi meson and the muon capture of the proton ; both studies were made with the small machine. A series of new neutrino experiments with a neutrino beam almost 100 times stronger than the Brookhaven beam are in preparation for 1963 at CERN, in order to study in detail the properties of the new neutrino and related phenomena, such as the fundamental question of the existence of a so-called intermediate boson.

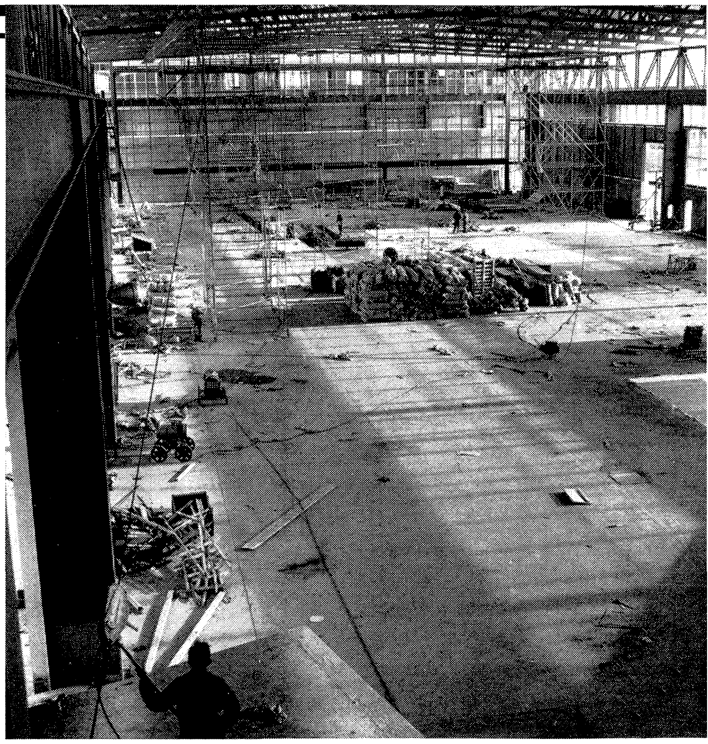
The contributions of our Theory Division played an important part in the discussions at the conference. They showed the value of a large and creative group of



In anticipation of the fast beam-ejection system, this special vacuum tank has already been placed between PS magnet units nos 100 and 1. Alain Burlet makes some adjustments on the q_2 beam which at present begins here.

theorists for an institution such as CERN. They provide the sounding board for new ideas, and their constant endeavour to find a meaning in the newly discovered facts contributes greatly to the spirit of excitement and interest in the Laboratory, which is so necessary for a fertile intellectual climate of discovery.

The year 1962 was also a year of expansion in buildings and facilities. Such an expansion was sorely needed in view of the steadily increasing number of most welcome scientific visitors from our Member states, who want to make use of our unique facilities. In addition to the CERN scientific staff, there are at present about 200 scientific visitors from all over the world working at CERN, including our fellows and research associates. However, our limited budget enables us to satisfy only the most pressing needs. The largest of our new constructions is the new experimental hall at the east of the PS ring. It will give us much needed new space for experimentation ; for the time being, however, it will be used mostly to accommodate the new large British bubble chamber, which is in the process of being installed by Imperial College, London. We hope, that during the coming years, we will get the necessary funds to make full use of this new facility.



The immense size of the new experimental hall in the East area may perhaps be judged from this view, taken at a late stage of its construction.

* * *

PROTON SYNCHROTRON MACHINE

During 1962 the average operation time per week of the 28-GeV proton accelerator was raised from 116 to 134 hours and the average intensity of the circulating beam raised by nearly a factor of 3.

The 'Experimental planning' group, formed at the beginning of the year to assist the Nuclear physics research committee in its task of achieving a rational use of the machine and its experimental areas, clearly justified itself. This experiment will be followed up and extended in scope.

A remarkable improvement in the performance of the linear accelerator characterized the last few months of the year. The maximum proton current obtained at 50 MeV rose to 45 mA, and the normal current delivered to the synchrotron was 30 to 35 mA — more than twice the value earlier in the year.

Several accelerating cavities in the synchrotron ring were modified to enable them to operate at a higher voltage. This will allow the total number to be reduced and thus free some of the long straight sections for other purposes. The present targetting system has been improved and completed, and more advanced systems are being studied.

More than a dozen different beams of varying complexity were set up during the year, and those in use in December were as follows :

- — separated kaons of momentum 800 MeV/c (k_3),
- — separated kaons, antiprotons, etc., with momentum (for antiprotons) up to 5.5 GeV/c (m_2),
- — low-energy pions (momentum 1 - 2 GeV/c) of high intensity (a_3),
- — high-energy pions (momentum 18 GeV/c), kaons and protons (d_{13}),
- — scattered protons of full accelerated energy (c_5),
- — low-energy pions (momentum 1 GeV/c) for testing apparatus (s_3),
- — monitor beams for measuring intensities of target bursts (targets 01, 06, 09, 10).

For the forthcoming neutrino experiment, an area of 160 m² in the South experimental hall was excavated to a depth of 70 cm to take part of the 4500 tons of steel shielding. A start was made on the installations for the fast beam-ejection system in the South target zone, and further progress was made with the slow ejection system. Design work was begun for beam ejection in the East area, but progress will depend on the financial situation in 1964-65.

SYNCHRO-CYCLOTRON MACHINE

The idea of converting the 600 MeV accelerator into a spiral-ridge cyclotron has proved to be disappointing and the present programme is concentrated on a number of other improvements.

By changing the r.f. supply to permit the use of higher frequencies, it has become possible to operate with a higher magnetic field. Owing to saturation effects, the increase is most marked in the centre, thereby strengthening the radial gradient and hence the vertical focusing. In this way the intensity of the secondary pion beams was increased by 50 % for the same number of accelerated protons. In addition, an amplitude modulator now allows the r.f. voltage to be optimized during the accelerating cycle, providing an increase of more than 50 % in internal intensity.

An experimental study of the beam extraction device has already led to a gain of three in intensity, following better adjustment of the components. Within a circle of 1.5 cm², 3×10^{11} protons/second arrive in the proton room. The increased SC magnetic field has also resulted in higher efficiency of the so-called 'stochastic' device, which now has an effectiveness of 60 % with a time-distribution factor of 50 - 60 % for pions.

In the polarized proton source the four polarization states of hydrogen have been separated. The intensity of the jet has also been increased but the oil pumps will have to be replaced by mercury-vapour pumps, in order to prevent polymerization of the oil by atomic hydrogen. Preparations are being made to install the source on the SC.

Work for improving the accelerator in all these fields is partly experimental and partly theoretical. The theoretical research is carried out in such a way that it could subsequently be easily applied to the design of a new spiral-ridge cyclotron, if such a machine were to be built in Europe.

A number of lead and niobium superconducting cavities have been tried out at a frequency of 280 MHz. Improvement factors of over 1000 were obtained, compared to operation at ordinary temperatures, but saturation effects were observed. These studies are to be shelved for budgetary reasons.

NUCLEAR PHYSICS APPARATUS

Except for the separator project, the entire NPA Division spent most of the year in preparation for the neutrino experiment. As well as continuing the realization of the enhanced neutrino beam, there have been studies of the neutrino flux distribution at the detectors, the shielding requirements, and the layout of the experimental area, and most of the programme of the bubble-chamber group is on problems connected with neutrino physics.

The fast ejection system is ready for assembly and tests. The magnetic circuits of the pulsed bending magnets and quadrupoles, for transport of the ejected beam, have been finalized from model measurements, and the beam-transport system, with power supplies, capacitor banks and beam-observation equipment, is being installed in the NPA hall for a reliability test. Construction of the neutrino horn and the 300 000-A pulsed power supply is complete.

The various separator tanks completed in the last year operated well, and two more of 10 m, two of 3 m and one of 6 m are being constructed. A pair of compensating magnets will eventually be incorporated in each separator, so as to obtain complete units with an integral crossed magnetic field. This will release the bending magnets currently used but always in demand for other beams.

Owing to the neutrino preparations, the studies in superconductivity are temporarily handicapped. However, a small air-cored d.c. magnet for 60 kG has been built, with which relations between current density and magnetic field have been measured for several superconducting alloys of European production. Collaboration has been established with manufacturers, who have kindly prepared samples for study.

ENGINEERING

The various mechanical-engineering sections of the Engineering Division have continued their work on such things as the 2-m hydrogen bubble chamber, the fast-ejection system and neutrino horn, the electron storage-ring model, and components of the proton synchrotron.

In the electrical-engineering group the installation section concentrated mainly on the d.c. power supply systems for the beam transport magnets and track chambers in the East area of the proton synchrotron. Acceptance tests of the 15 motor generator sets for beam transport were carried out successfully and the 2 motor generator sets with a total power of 6000 kW for the 2-m bubble chamber excited the magnet for the first time at the beginning of October. The installation of the d.c. supply systems has progressed satisfactorily.

The d.c. supply system for the track chambers in the South PS area has been extended, so that it is now possible to supply chambers in all parts of the South and North halls.

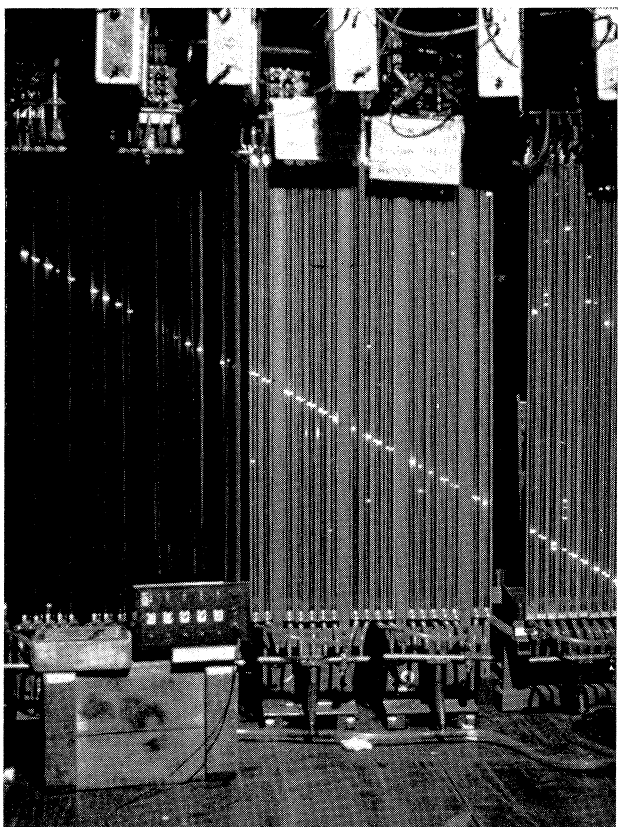
The cooling section has completed the installation of a 10-MW cooling system, including the water-supply piping for the East area.

Among other work of many kinds was the development of controlled solid-state rectifiers, giving 500 A at 115 V, a new timer for the PS magnet power supply, and improvements to the remote-control and regulation systems for beam-transport power supplies. The magnet section has studied new slim bending magnets and quadrupole lenses.

NUCLEAR PHYSICS

The main line of experiments carried out by the NP Division at the proton synchrotron was on the study of high-energy collisions between nucleons or pions and nucleons. In particular, a new light was thrown on the behaviour of elementary particles by the observation that in the elastic scattering of protons on protons, the 'diffraction peak' at small angles of

A 20-ton spark chamber, with plates 1.6 m square will be used to study neutrinos. Some of the units under test here show the track of a cosmic-ray particle.



scattering shrinks as the energy of the incident protons is raised.

At the synchro-cyclotron, research continued to be concentrated on muon physics and pion decay. The existence of two rare, hitherto unobserved processes was established : the decay of the positive pion into a neutral pion with emission of a positron and a neutrino, and the 'radiative capture' of the muon.

The use of spark chambers as an experimental technique was widespread ; promising results were obtained in the development of new types of discharge chamber and sonic spark chambers.

The direct participation of outside universities and other institutions in the experimental work of the Division is illustrated by the fact that the present number of fellows, research associates, visiting scientists and visitors is 60, compared with 40 scientists who are staff members.

TRACK CHAMBERS

Considerable progress was made with the erection of the CERN 2-m liquid-hydrogen bubble chamber during the year, although much remains to be done and it will be another twelve months before the chamber body and cold tanks are ready for installation.

Physics experiments have continued throughout the year using mainly the Saclay/École Polytechnique 81-cm hydrogen bubble chamber and the École Polytechnique 1-m heavy-liquid bubble chamber, as well as the CERN 32-cm hydrogen chamber. These experiments, and particularly the analysis of the data, have involved many other laboratories in the various CERN Member states.

Towards the end of the year a new beam was set up to provide separated kaons of momentum up to 3.5 GeV/c and antiprotons up to 5.5 GeV/c, opening the way to studies with the 81-cm chamber in a field of energy which has never before been reached.

DATA HANDLING

Eight IEPs, the instruments currently used for measuring the tracks on bubble-chamber photographs, are now in operation. 'Events' measured with them are being computed with a new generation of programmes. First, the punched tape from the IEP is read by REAP, a Mercury programme which carries out systematic checks and transcribes the information on to magnetic tape (a technique for using Mercury in conjunction with magnetic tape was developed recently at CERN). The 709 continues with the geometrical reconstruction programme THRESH, and the GRIND programme then computes the kinematics. A definite improvement in quality has been brought about by REAP, which systematically checks the accuracy of the measurements made by each operator, revealing any consistent errors and thus making training easier.

In the development of new techniques, progress with the Hough-Powell system of automatic measuring has continued, in co-operation with Berkeley, Brookhaven and the Rutherford Laboratory. The 'Mark I' HPD now regularly provides programmers with the necessary data for their tests, and several 'digitized photos' recorded on magnetic tape have been sent to the co-operating laboratories for the same purpose. The 'Mark II' has been designed in very close co-operation with the Rutherford Laboratory, and several essential improvements will be incorporated. Various other European laboratories are showing a keen interest.

For the analysis of spark-chamber photographs, a simplified and economical measuring instrument ('IEP Junior') has been designed. More ambitiously, a cathode-ray device ('Luciole') making use of the same logic and programming principles as the HPD is being developed.

The programming and development groups receive visitors from many laboratories and an appreciable part of their work consists of training. A leading programmer has been invited to visit several American laboratories interested in using programmes developed at CERN. An electronics engineer spent a year at the Massachusetts Institute of Technology, helping to develop a 'next-generation' automatic scanning and measuring device (PEPR).

THEORY

At the end of 1962, the 54 places available in the Theory Division were occupied by 14 staff members, 27 fellows and research associates (22 from Member states and 5 supported by the Ford Foundation grant), and 13 visiting scientists (10 from Member states). Work has continued in all main chapters of theoretical elementary-particle physics and in a few associated fields. Prominent among the new results obtained are theorems on the restrictions imposed on scattering amplitudes by the 'unitarity condition'. A wealth of additional results has been obtained in the framework of the 'multiperipheral model' of high-energy collisions, a field-theoretical model capable of giving a simultaneous description of inelastic collisions and a shrinking diffraction peak. The actual fitting of high-energy scattering data by means of Regge trajectories has been carried out for proton-proton and antiproton-proton

Framed by the coils of the magnet for the CERN 2-m liquid-hydrogen bubble chamber, Roland Frachet takes some measurements on the electrical system of the hydraulic jacks.

scattering. Extensive earlier work on the analysis of pion-nucleon and nucleon-nucleon scattering at moderate energies has been improved and completed.

Various problems in the theory of strange particles have been studied, some of which relate to the production of kaon pairs in antiproton-proton annihilation. Further work has been done on large-angle elastic scattering, using the statistical model. Computer programmes for particle production in the statistical theory have been translated for the 709 computer and largely automatized for practical use by experimenters.

Contributions were made to a variety of problems concerning weak interactions and quantum electrodynamics. In the field of nuclear physics, work has continued on negative-pion capture in light elements and on nuclear cross-sections in the region of overlapping resonances. Abstract field theory and many-body theory were also given further study.

Altogether some 80 papers covering these various subjects were published during the year. Study groups have been formed to review all important aspects of the Regge-trajectory description of high-energy scattering and of the theory of weak interactions. They meet regularly to discuss specific items on the basis of the existing literature and to determine which questions require further clarification.

ACCELERATOR RESEARCH

The 2-MeV electron storage-ring model is now nearing completion and will be put into operation early in 1963. Tests on the ultra-high-vacuum system indicate that the complete system should conform with the specification of 10^{-9} torr (nearly a million million times less than atmospheric pressure). An 'omegatron', used to analyse the residual-gas composition in ultra-high-vacuum systems, has measured partial pressures of 2×10^{-12} torr.

The microwave radiofrequency separator at present under construction is intended to provide separated beams of antiprotons and positive or negative kaons with momenta up to 20 GeV/c, at intensities suitable mainly for bubble chamber use. The first r.f. separated beam will be combined with a single-stage electrostatically separated beam to serve the National British Bubble Chamber, the e.s. separator operating up to 8 GeV/c and the r.f. separator up to about 15 GeV/c, a limit imposed mainly by intensities available from an internal target. A preliminary study has shown that r.f. separation of secondary particles should be feasible in the momentum range 100-200 GeV/c.

A Study Group consisting of 5 scientific staff, 1 research associate, 1 Ford fellow, 4 visiting scientists, and part-time effort from other laboratories and CERN divisions, has considered two high-energy projects in some detail. In one, a new arrangement of storage rings for the PS, in which the two rings would be concentric and have 8 intersection regions, has proved to be a better scheme than the one considered earlier. Detailed analysis of a few possible and interesting experiments with colliding beams has been made.

The main emphasis on studies for a large proton synchrotron has been on getting out tentative parameters necessary for a more accurate determination of

Nuclear-physics experiments at CERN in 1962

USING THE PROTON SYNCHROTRON

1. **Proton-proton scattering** – 'shrinking diffraction peak' discovered, measurements continuing.
2. **Proton-antiproton annihilation into lepton pairs** – equipment tested.
3. **Photon production in pion-nucleon collisions** – equipment being prepared.
4. **Di-boson production in pion-nucleon collisions** – 250 000 spark-chamber pictures taken.
5. **Lifetime of neutral pion** – found to be $1.05 \pm 0.18 \times 10^{-16}$ second.
6. **Muon-proton scattering** – design completed for muon channel at PS.
7. **Neutrino experiment** – spark chambers constructed and tested with several kinds of particles.
8. **K^0_2 studies** – pictures taken with CERN/ETH cloud chamber now being analysed to determine mean life and decay properties.
9. **Polarization of neutral sigma hyperon** – spark-chamber pictures being analysed.
10. **Strange-particle production by interaction of 10-GeV/c negative pions with protons** – analysis of pictures from 81-cm hydrogen bubble chamber (81 HBC) almost completed.
11. **Interactions with protons of antiprotons at rest** – detailed results from 81 HBC obtained on the production of particles.
12. **Interactions of 3, 3.6 and 4-GeV/c antiprotons with protons** – detailed analysis of photographs from 81 HBC continuing.
13. **Elastic scattering and pion production by fast antiprotons** – preliminary results obtained with 81 HBC.
14. **Interactions of 1.47-GeV/c negative kaons with protons** – analysis of photographs from 32-cm HBC in progress.
15. **Interactions of 1.5-GeV/c negative kaons** – analysis continuing of pictures taken in École Polytechnique heavy-liquid chamber.
16. **Relation between changes of strangeness and charge in kaon decay ($\Delta S/\Delta Q$)** – photographs taken in École Polytechnique heavy-liquid chamber.
17. **Relative parity of sigma and lambda hyperons** – experiment with 81 HBC in progress.
18. **Decay of neutral lambda hyperon into leptons ; decays of eta and omega mesons into neutral particles ;** and **neutral-sigma polarization** – studied by Argonne group with spark chamber operating in magnetic field.
19. **Magnetic moment of positive sigma hyperon** – experiment using nuclear emulsions completed.
20. **Magnetic moment of neutral lambda hyperon** – emulsion experiment prepared.
21. **Antiproton and negative-kaon reactions in emulsions** – stacks exposed for several laboratories inside and outside Europe.
22. **Uranium fission by 24-GeV and 600-MeV protons ; negative pion reactions in copper-65 ;** and **peripheral reactions by 19-GeV protons in copper** – studied by nuclear-chemistry methods.
23. **Reactions in aluminium and carbon suitable for monitoring proton beam** – absolute measurements of cross-sections being prepared by nuclear-chemistry group.

USING THE SYNCHRO-CYCLOTRON

1. **Muon scattering on carbon** – no departure found from theoretical expectations.
2. **Muon capture in hydrogen** – results agree, within 12 %, with prediction of Universal Fermi Interaction.
3. **Radiative muon capture** – several events detected, new equipment now ready.
4. **Formation of molecules incorporating negative muons instead of electrons** – rates measured in liquid hydrogen.
5. **Decay of positive pion to neutral pion** – existence established and probability relative to normal decay mode measured. Radiative decay of pion also investigated.
6. **Polarization of positrons in decay of positive muons** – results being analysed.

the actual size and cost of such a project. A 300-GeV machine will have a diameter of 2.4 km, giving a circumference of about 7.5 km of which the main magnet occupies 70 %. Two alternative schemes for injection are being actively examined. A special study of the future physics to be done with bigger machines has started and it is hoped that other European laboratories will collaborate in this in the same way as for the more technical study.

SITE AND BUILDINGS

During the six months May-October, the Design and Planning Service of the SB Division designed projects, requested tenders and started work on twenty-six new installations. Considerable alterations and extensions of existing installations have also been undertaken.

The constant expansion on the present site, and the need in the near future to take into account the extension of this site into France, has required a reconsideration of the whole question of basic supplies. Design work for the installation of a large 130/18 kV electricity sub-station to supply 90 MVA has been continued, and almost all the equipment ordered. The internal supply and drainage networks have been completely reviewed, to ascertain their exact capacity, and preliminary design work for fitting up the new site in France is now in hand to obtain cost estimates.

In the Main workshop, the number of large machines is still not sufficient to keep up with the demand, and three shifts continue to be worked to use them to the best advantage. The manufacture of targets, counters, measuring instruments, beam-transport equipment, and instruments for the evaluation of photographs, deserves special mention. The West workshop, transferred from Engineering to SB Division in June, was mainly occupied in constructing equipment for the neutrino experiment, and manufacturing apparatus, high-vacuum tanks, measuring and monitoring instruments, and other specialized equipment not available on the market.

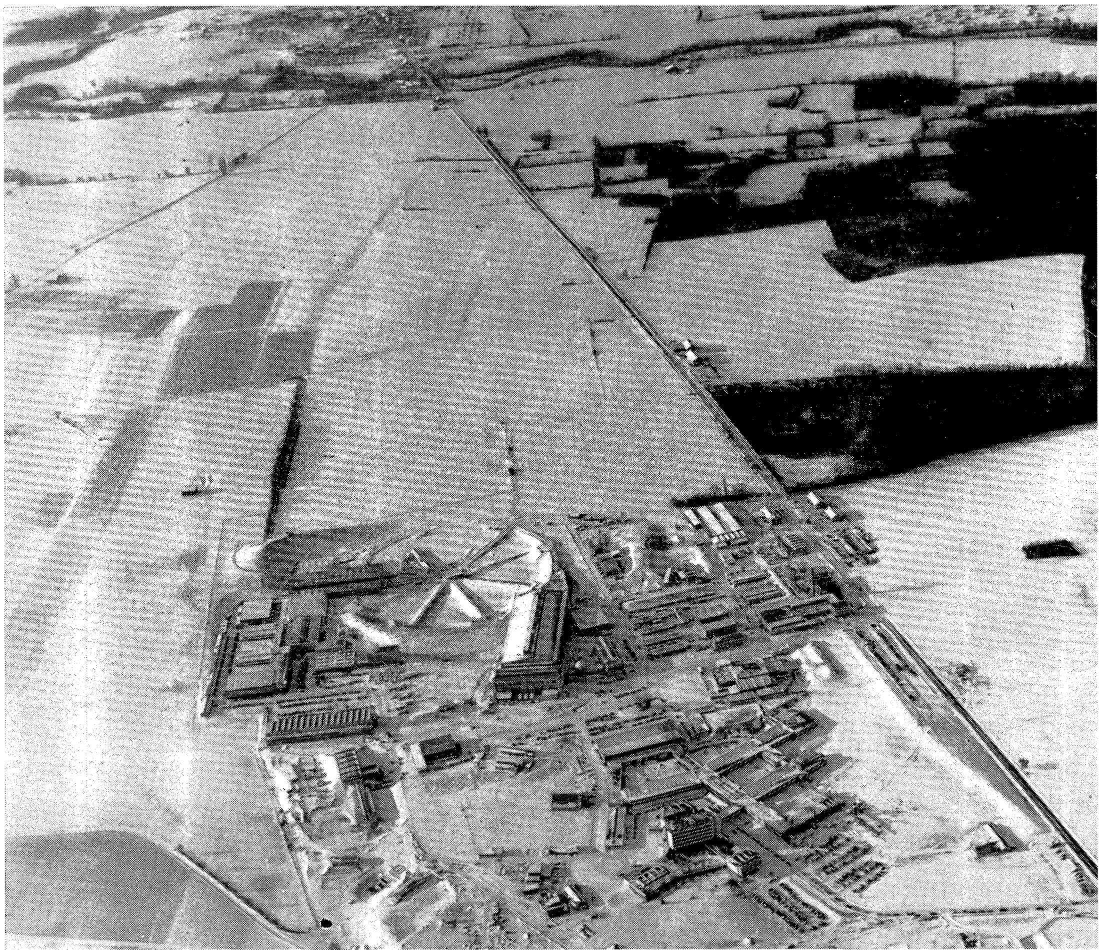
GENERAL SAFETY AND HEALTH PHYSICS

During 1962 the General Safety Group was reorganized and made immediately responsible to the Directorate. The functions of this Group, which comprises a safety engineer and five staff, are to inspect all work and installations, to advise divisions on safety problems of old as well as new equipment, to train supervisors in safety precautions, to make accident reports and to keep records. Improved control over the materials used for new equipment or construction work has been brought about by the use of radiographie inspection. It is no doubt significant that the accident rate in 1962 was about 30 % lower than in 1961.

The first stage in developing the Health Physics Group was completed at the beginning of October, by which time the number in the Group had reached 21.

A self-service film-badge distribution was arranged at the entrance to the PS ring and the SC machine room; additional control of the radiation exposure was found necessary for all work on the PS ring, because of the induced radioactivity. An emergency service for film-badge evaluation was also instituted, in case of radiation accidents.

Radiation surveys were carried out to determine the variations of the neutron dose-rate within the CERN laboratories, the calibration and study of instruments for radiation dose measurements were continued, and two methods of dosimetry (the bismuth-fission chamber and the carbon-11 scintillator) were developed further with the aim of introducing them into the routine surveys ●



**The size of the new experimental hall in the East area of the PS can be further seen from this aerial view of CERN covered by a thick layer of snow. The adjoining area of land offered by the French government stretches towards the top of the picture.
Some of the staff-members' houses at Parc Bugnon, Saint-Genis-Pouilly, can just be seen in the top right-hand corner.**

Looking ahead

Research budget and extension into France discussed at 23rd Session of CERN Council

COUNCIL OFFICERS RE-ELECTED

At its session on 19 December, the delegates to the CERN Council re-elected all its chief officers, as follows :

President — Mr. Jean WILLEMS (Belgium) ;
Vice-presidents
— **Prof. E. AMALDI** (Italy),
— **Mr. J.H. BANNIER** (Netherlands) ;
Chairman of the Scientific Policy Committee
— **Prof. C.F. POWELL** (United Kingdom) ;
Chairman of the Finance Committee
— **Dr. G.W. FUNKE** (Sweden).

For the first four, this will be the third successive year in which they have held their present offices. For Dr. Funke, who was first elected chairman of the Finance Committee in December 1961, it will be his second year. All five of them have been closely connected with CERN for many years, most of them from the earliest days of the 'Conseil', before the establishment of the Organization in its present form.

The new composition of the **Committee of Council** was also decided. In addition to the officers already mentioned, who are members ex officio, the members elected were :

Mr. François de ROSE (France), re-elected
Prof. W. HEISENBERG (Federal Republic of Germany),
Sir Harry MELVILLE (United Kingdom), re-elected
Prof. M. FIERZ (Switzerland), representing Spain and Switzerland,
Prof. W. THIRRING (Austria), representing Austria and Greece,
Prof. B. TRUMPY (Norway), representing the Scandinavian group, Denmark, Norway and Sweden.

The 23rd session of CERN Council was held on 19 December, 1962, under the presidency of Mr. Jean Willems (Belgium). The president opened the session by a tribute to the memory of Prof. Niels Bohr, one of the founders of CERN, who died on 18 November.

European physicists share CERN success

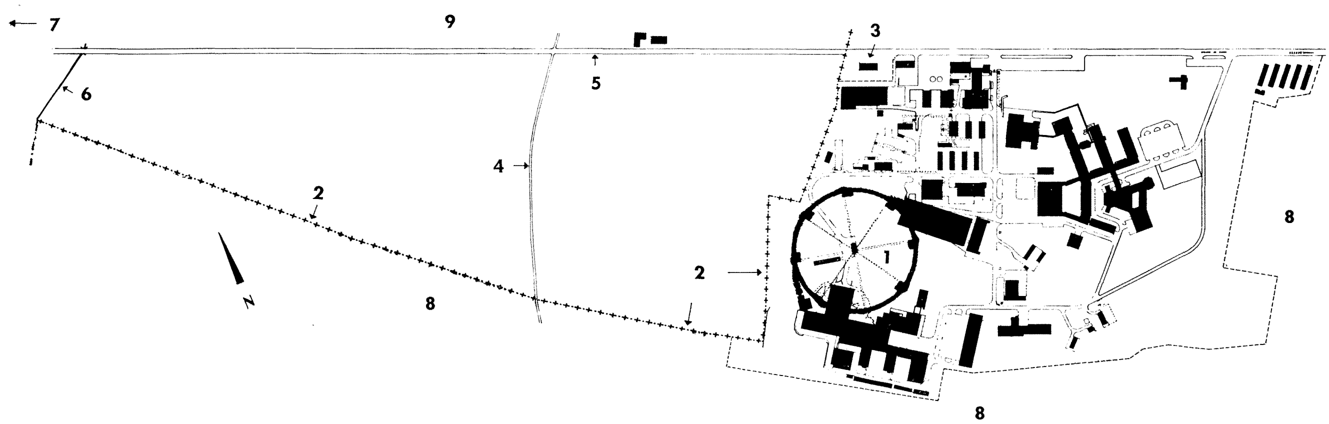
Commenting on the progress report of the Organization, Prof. V. F. Weisskopf, the Director-general, stated that '1962 was a decisive year for CERN ... which now has a healthy scientific programme exploiting reasonably well the opportunities of the two accelerators, within the limits of our present state of development'.

He pointed out that CERN, in collaboration with other research establishments in Europe, has contributed important results in all three lines of research which seem to be the centre of interest today in the world-wide quest for knowledge of the constitution of matter*. In all these lines, CERN has established important facts which have enabled it to emerge for the first time as one of the leading institutions in this field of research. However the achievements of CERN are those of scientists all over Europe, since large parts of the experiments are studied and evaluated in many other European laboratories.

CERN not yet fully exploited

In a statement concerning the programme and budget, however, Prof. Weisskopf issued a warning, pointing out that the success of our laboratory does not mean that its facilities are fully exploited. Because of insufficient spending in the last few years, much more financial support than is even now proposed would be needed to make the fullest use of all the research possibilities offered at present.

* See also p. 3. of this issue.



1. 28-GeV proton synchrotron
2. French-Swiss border
3. Swiss customs
4. Tonkin road (to Bourdigny, Switzerland)
5. Nationale 84 (Lyon-Geneva road)
6. Nant de l'Ecra (stream)
7. French customs (440 yards away)
8. Switzerland
9. France

PROPOSED EXTENSION OF CERN ON TO FRENCH TERRITORY

The member States which brought CERN into being and encouraged it to build the accelerators that are now working, he suggested, should support the exploitation of CERN in the same spirit as they fully supported its construction. Our laboratory, which is at the centre of Europe in the field of high-energy physics, must not fall behind similar laboratories elsewhere in the world, and its capacity of exploitation must not be restrained if it is not to become a second-rate institution.

Another reason for the fullest growth of the facilities at CERN is the development of European physics. 'This branch of science is in the midst of an extremely gratifying upsurge, characteristic of the new wave of optimism pervading so many activities in Europe', said Prof. Weisskopf to the Council members. 'This unparallelled resurgence of scientific activity and interest, which has taken place in the last decade, is one of the greatest events of our times'. The Director-general also stated that as CERN is part of this situation it must fulfill the demands for more and better opportunities of work, and more scientific material for study and exploitation, by the rapidly growing number of European scientists entering the field and anxious to contribute to it.

As now foreseen, a full exploitation of CERN would require 2200 or more personnel (staff, fellows and visitors) against the 1450 it has now.

94.2 million Swiss francs for 1963

Voting the budget for 1963, the Council authorized CERN to spend 94.2 million Swiss francs in 1963 to pursue its basic research in nuclear physics.

The sum corresponds to an increase of 13 % over the budget voted for 1962, together with an allowance of 3.6 % for price increases. From this should be deducted 1.7 million from miscellaneous receipts. Contributions from Member states amount therefore to 92.5 million Swiss francs, divided on a percentage basis as follows :

Member state	Per cent
Austria	1.92
Belgium	3.78
Denmark	2.05
Federal Republic of Germany	22.47
France	18.34
Greece	0.60
Italy	10.65
Netherlands	3.87
Norway	1.46
Spain	3.36
Sweden	4.18
Switzerland	3.15
United Kingdom	24.17
Total	100.00

CERN to expand into France

Another important development was the Council's approval in principle of an extension of the CERN site into French territory. 'CERN could be the first international organization with a site extending on either side of an international frontier', declared Mr. François de Rose, Ministre plénipotentiaire of France.

This new move had its origin as early as 1958, when the then Director-general, Prof. C.J. Bakker, expressed the fear that CERN might lack space on its present site. A survey of the surrounding area subsequently showed that the most favourable direction for expansion would be on to French territory. An approach was made through the French delegation, and at this meeting of Council the delegates of France gave the news that their Government is willing to put at CERN's disposal an area of land in the Commune of St. Genis (Department of Ain), immediately adjoining the present site. This land, alongside the main road from Geneva to Lyon, would have an area of about 40 hectares (100 acres), that is, about the same as that of the present CERN site, which was placed at the disposal of the Organization by the Swiss in 1953. The Swiss authorities have already been approached by the French and have reacted favourably to this proposal to extend CERN across the frontier.

CERN's use of the area that has been offered poses some problems of a practical, diplomatic and administrative nature, both between CERN and France and between France and Switzerland. Suitable agreements will thus have to be negotiated. The Director-general was authorized by the Council to begin negotiations on such an agreement governing the relations between CERN and France, and it is foreseen that it would come into force some time during 1963. It is estimated that it will be about one year before CERN can take possession of the new ground. Building work could then be started on the section nearest to Switzerland ; it will be some time, however, before the whole area can be used for buildings of any size.

'We have here a magnificent offer', declared Prof. V.F. Weisskopf, 'full of promise, as much for the generosity of the offer as for the assistance it will be to CERN. Today more than ever CERN symbolizes the unity and co-operation of the nations of Europe in the scientific field.' ●

23rd Session of Council

PARTICIPANTS

President : Mr. J. Willems **(Belgium)**

Austria

Prof. W. Thirring
Prof. F. Regler
Mr. H. Vavrik *

Belgium

Prof. P. Capron
Prof. J. Serpe *

Denmark

Prof. J.K. Bøggild
Mr. O. Obling
Mr. J. Hornemann *

Federal Republic of Germany

Prof. W. Gentner
Dr. W. Schulte-Meermann
Prof. W. Paul *
Prof. W. Jentschke *

France

Mr. F. de Rose
Prof. F. Perrin
Mr. J. Martin *
Mr. J. Courtillet *
Mr. E. Grondard *

Greece

Prof. N. Embiricos
Prof. Th. Kouyoumzelis
Mr. A. Vlachos *
Mr. A. Petropoulos *

Italy

Mr. F.P. Vanni d'Archirafi
Prof. E. Amaldi
Mr. M. Gigliarelli *
Mr. M. Sabelli *
Mr. F. de Courten *

Netherlands

Mr. J.H. Bannier
Prof. S.A. Wouthuysen
Prof. C.C. Jonker *

Norway

Mr. S.Chr. Sommerfelt
Mr. O. Lydvo *

Spain

Prof. J.M. Otero Navascués
Mr. J.M. Aniel-Quiroga **
Prof. C. Sánchez del Río **
Mr. L. Arroyo-Aznar *
Mr. R. Ortiz Fornaguera *

Sweden

Dr. G.W. Funke
Prof. I. Waller

Switzerland

Mr. A. Chavanne
Prof. M.E. Fierz
Mr. S. Campiche *
Mr. E. Egger *
Mr. R. Bieri *

United Kingdom

Sir Harry Melville
Dr. J.B. Adams
Dr. T.G. Pickavance **
Mr. R.St.J. Walker **
Mr. G. Hubbard *

Observers

Mr. H. Fahir Alaçám **(Turkey)**
Mr. S. Soc **(Yugoslavia)**

* Adviser ** Alternate

Also present were the chairman of the Scientific Policy Committee, and the Director general, members of the Directorate and Division Leaders of CERN.

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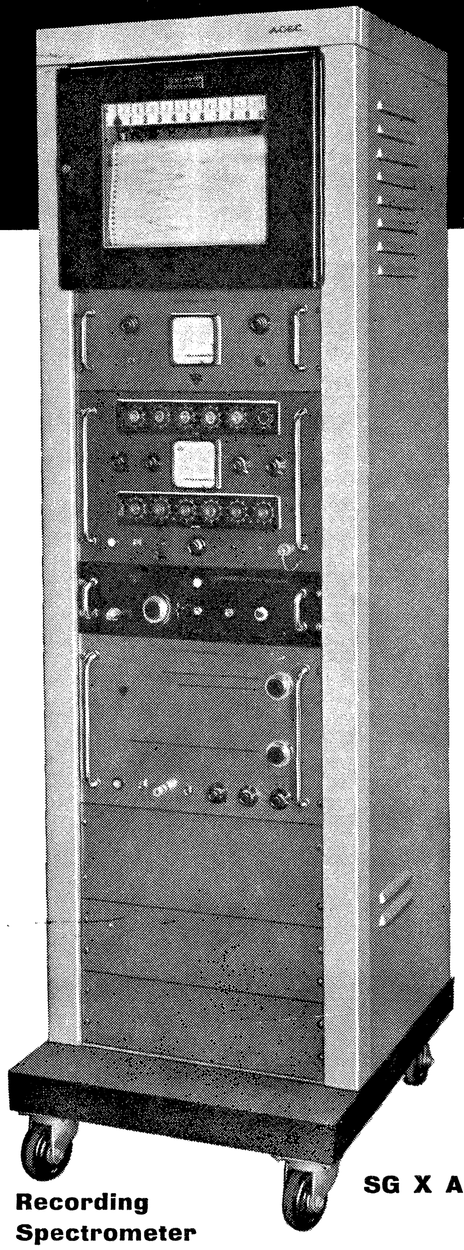

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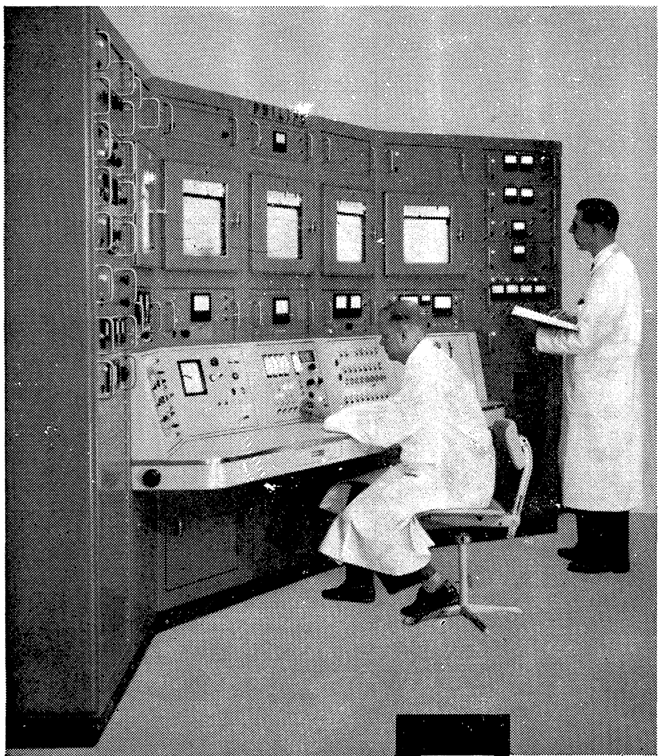
PHILIPS

nuclear reactor instrumentation

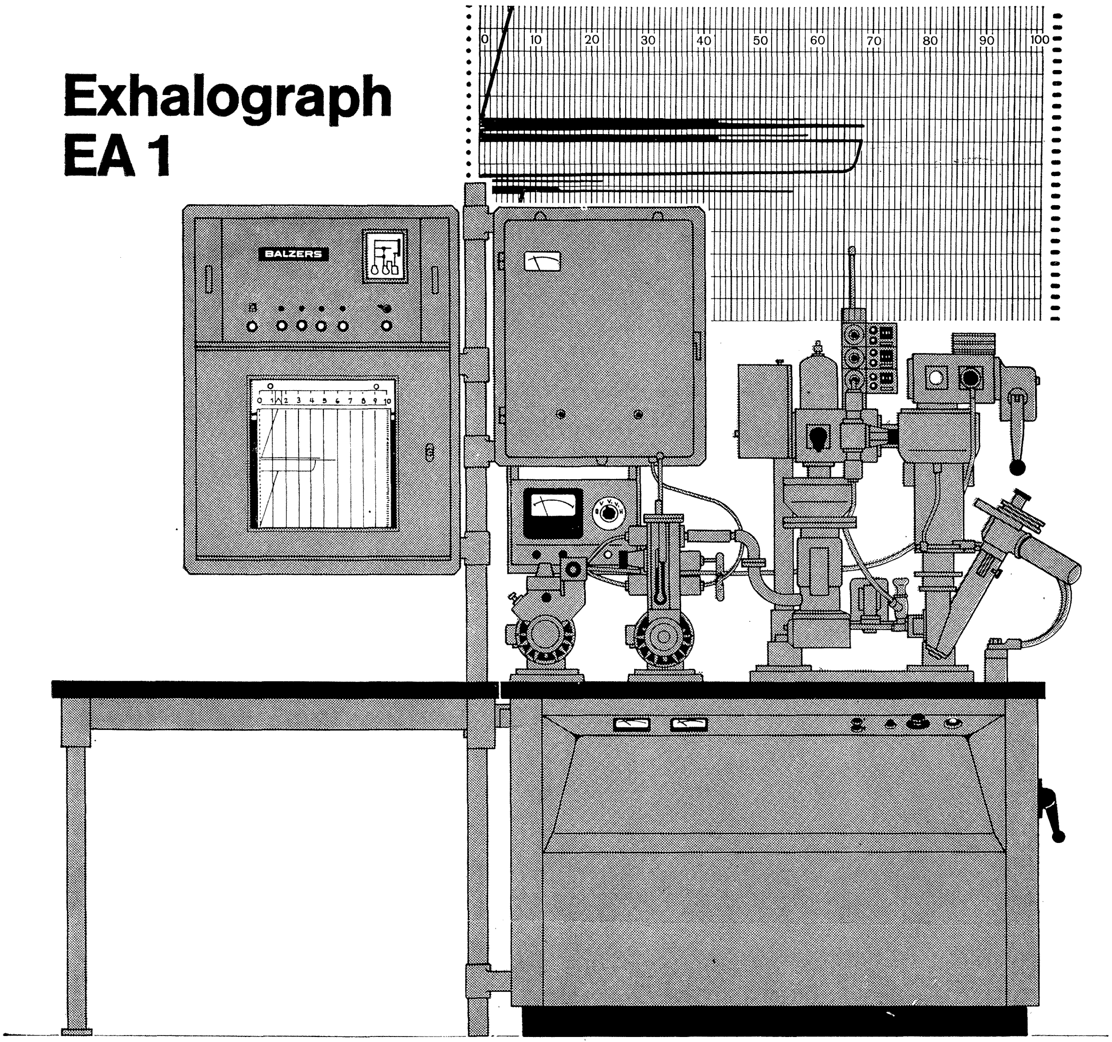


Philips have designed and supplied complete systems for the operation of nuclear reactors.
Such control and monitoring instrumentation is aimed at operation of the reactor to fulfil its function and providing adequate protection against radiation hazards.
To obtain co-ordinated functioning of the control devices, circuits are incorporated for combining information from the instruments used for measuring, recording, and control.
Shown here are the combined control console and equipment racks for the swimming pool type research facility, recently delivered to the Technische Hogeschool, Delft, The Netherlands.

PHILIPS NUCLEAR EQUIPMENT

N.V. PHILIPS' GLOEILAMPENFABRIEKEN - EINDHOVEN - THE NETHERLANDS - SCIENTIFIC EQUIPMENT DEPARTMENT

Exhalograph EA 1



2 minutes for the determination of the oxygen contents in steel

Metallic apparatus for the automatic and exact analysis of the oxygen, the hydrogen and the nitrogen contents in metals by the vacuum fusion method.

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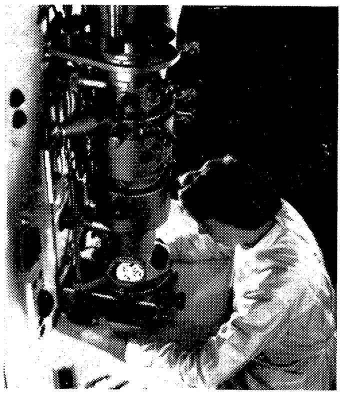
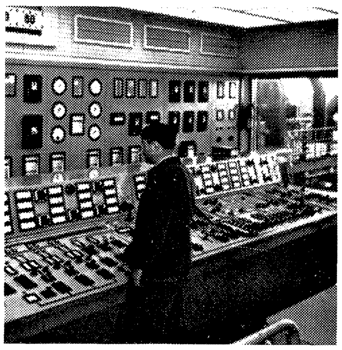


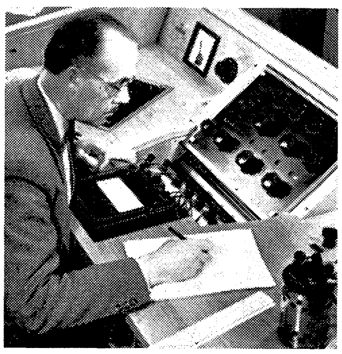
Measurement and control in thermal and processing techniques

Electrical metrology



Electronic microscopy

Non-destructive testing of materials



Measurement of mechanical quantities

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