CERN COURIER

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European Organization for Nuclear Research

CERN, the European Organization for Nuclear Research, was established in 1954 to '... provide for collaboration among European States in nuclear research of a pure scientific and fundamental character, and in research essentially related thereto'. It acts as a European centre and co-ordinator of research, theoretical and experimental, in the field of sub-nuclear physics. This branch of science is concerned with the fundamental questions of the basic laws governing the structure of matter. The Organization has its seat at Meyrin near Geneva in Switzerland. There are two adjoining Laboratories known as CERN Laboratory I and CERN Laboratory II.

CERN Laboratory I has existed since 1954. Its experimental programme is based on the use of two proton accelerators — a 600 MeV synchro-cyclotron (SC) and a 28 GeV synchrotron (PS). Large intersecting storage rings (ISR), are fed with protons from the PS for experiments with colliding beams. Scientists from many European Universities as well as from CERN itself take part in the experiments and it is estimated that some 1200 physicists draw research material from CERN.

The CERN Laboratory I site covers about 80 hectares almost equally divided on either side of the frontier between France and Switzerland. The staff totals about 3000 people and, in addition, there are about 850 Fellows and Visiting Scientists. Twelve European countries contribute, in proportion to their net national income, to the CERN Laboratory I budget, which totals 371.4 million Swiss francs in 1972.

The CERN Laboratory II was authorized by ten European countries in 1971. A 'super proton synchrotron' (SPS), capable of a peak energy of hundreds of GeV, is being constructed. CERN Laboratory II also spans the Franco-Swiss frontier with 412 hectares in France and 68 hectares in Switzerland. Its budget for 1972 is 95 million Swiss francs and the staff will total about 300 people by the end of the year.

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Cover photograph: Heavy hoar frost in December converted the CERN site into a scene of rare beauty. (CERN 276.12.71)

47th Session of CERN Council

The Council met on 16, 17 December under the Presidency of Professor E. Amaldi

Compared with previous years, the December 1971 Council Session was very calm ; its business was conducted smoothly and quickly. On the surface there was a distinct anti-climax after the cliff-hanging debates of the pre-300 GeV decision years. However this seeming tranquillity may have reflected exhaustion of the delegates of Member States because some intense, intricate meetings on financial matters, of vital importance for the work of CERN in the next few years, had preceeded the Council Session.

It is customary for the Council at its December meeting to vote the budget for the coming year, to establish a ' firm estimate ' for the following year (which is only modified in the light of approved major changes in CERN's programme or of major changes in the financial situation in Member States) and to establish ' provisional determinations ' for the two subsequent years (which CERN and the Member States use as a good guide to the likely financial situation in those years). This so-called ' Bannier procedure ' has been of great benefit to CERN in its long-term planning.

The discussions prior to the 47th Session of the Council were particularly concerned with the CERN Laboratory I budgets and there were three factors complicating the decisions — some countries, which are experiencing immediate financial problems, asked for special budget reductions in 1972 ; the ' cost variation index ' (which protects the CERN budget from the effects of inflation) yielded an unusually high figure ; the Laboratory I budgets were already cut back as a contribution to the financing of the new accelerator in Laboratory II.

The first factor was accommodated by easing the 1972 budget situation for both Laboratories. In particular the Laboratory II budget came down by 20 million Swiss francs compared with the original estimate for 1972. This was because the ' profile of expenditure ' for the Laboratory has been moved back slightly since its programme began on 19 February 1971 rather than 1 January 1971. In Laboratory I, 3 million Swiss francs were trimmed from the original estimate to take account of the recent parity changes which in general have moved in favour of the Swiss franc and should thus result in a saving in CERN purchases. In addition 3 million Swiss francs were moved from the 1972 budget into the following year, adding to the firm estimate for 1973.

The second factor was the subject of long negotiation. The cost variation index came out at 6.55 % and this would normally have been applied to increase the firm estimate agreed at the 1970 December Council meeting for the 1972 budget. The index reflects the increases in the prices of manufactured goods and raw materials used by CERN and also has a large salary component which takes account of salary increases in Member States and the cost of living increase in Geneva. It was finally decided to apply a cost variation index of 6.32 % but to hold back the salary increase for CERN staff until 1 March (rather than applying it on 1 January).

The outcome of these manoeuvres was as follows (at 1972 prices) : For CERN Laboratory I — 1972 budget 371.4 million Swiss francs, 1973 firm estimate 359.9 MSF, 1974 and 1975 provisional determinations 345.5 MSF. For CERN Laboratory II — 1972 budget 95 MSF, 1973 firm estimate 176.7 MSF, 1974 provisional determination 200 MSF, 1975 provisional determination 194.5 MSF. (The Laboratory II figures are subject to retroactive adjustment, as were the budgets for the construction of the Intersecting Storage Rings, when the cost variations which actually materialize for the project are known. The two methods have, in fact, given figures very close to one another in recent years.)

We will now spend a little time discussing the third factor in our list above — the impact of the budget cuts on the programme at Laboratory I. It was typical of the excellent relations between CERN and the Member States that the budget debates were carried out with an appreciation of the problems on both sides. CERN and the Member States were both concerned to ensure financial support which would continue to sustain a top-class physics programme while holding the budgets down to figures acceptable to the European governments.

The money foreseen for Laboratory I (when account is also taken of the fact that some of it will go to preparing for physics at the Laboratory II machine) will fall at a rate of 6 % per year. Unfortunately, because of the large support structure necessary at accelerator Laboratories (where a very high percentage of the total expenditure is committed whether one experiment or thirty experiments are done), this 6 % cut corresponds to about 25 % cut in the previously anticipated physics programme at the PS, ISR and SC.

The future programme of CERN Laboratory I

A lot of discussion preceded the decisions on how to apply the budget restrictions in Laboratory I. There have been review meetings on various aspects of the programme (where representatives of the whole high energy physics community in Europe could make their views felt), a variety of internal meetings, and finally an Evaluation Committee (consisting of the Laboratory I Directors and the

Chairman of the Experiments Committees, advising the Director General). The outline result of the evaluation is as follows.

The first obvious step was to study all CERN activities to see what savings could be made by belt-tightening, wherever possible, without affecting the planned physics programme. This involved cutting back on services, improving operating efficiencies, simplifying administrative procedures, lowering standards, etc... and resulted in an estimated saving of about 20 MSF per year. But this unfortunately is not enough and further steps involved cutting into the previously planned physics programme.

The levels of exploitation which had been foreseen for the complex of equipment at CERN will be cut back and some activities delayed. For the next few years there will be no major increase in physics output compared with 1971. Thus in bubble chamber physics the picture taking rate per year will be limited to about 8.5 million (compared with the planned 12 million) involving the operation of the 2 m hydrogen chamber, the heavy liquid chamber Gargamelle, and the 3.7 m hydrogen chamber BEBC (from the end of 1972). The 80 cm hydrogen and 1.2 m heavy liquid chambers have been closed down. The use of deuterium or neon fillings in BEBC will await SPS beams.

For electronics experiments, no extension in terms of new beams and more experiments will be implemented with the exception of the beam in the West Hall to the Omega spectrometer. The installation of multiwire proportional chambers in Omega will be delayed. The large West Hall will therefore not be developed as previously intended and will be limited in exploitation to BEBC and Omega until beams are installed to take energies of 200 GeV from the SPS. This represents a cut back of about 20 % for the next few years, compared with previous plans.

The ISR has already mounted a very lively experimental programme and this will continue at its present level, although the demand from European physicists for time on the ISR is greater than anticipated and more could, physically, be accommodated. Also the running time will be cut from the planned 4000 hours to 3000 hours per year. Any major improvements to the ISR and its experimental equipment which appear feasible and desirable are likely to be delayed.

The PS Booster will be brought into operation in 1972 as intended but the high intensity beams from the PS, which the Booster will make possible, will not, in general, be exploited until the SPS is in action. Shielding, ejection systems, etc., to cope with higher intensities will then not be needed as quickly.

The growth in computing capacity will be limited compared with previous plans. Development of bubble chamber film analysis equipment will be restricted. The exploitation of the 600 MeV synchro-cyclotron, following its improvement programme to be implemented in 1972, will be held close to its present level.

These programme changes will also bring reductions in the number of staff in CERN Laboratory I. The previously estimated number for 1974 was 3450 but the new figure is likely to be under 3100. It is hoped that the number of visitors can be held close to the previous estimates.

There remain some questions which are still unresolved. First, there is considerable doubt that the reduced programme will be able to cater for the still growing demand for the use of CERN facilities from the scientists in the Member States. Secondly, it is too early in the life of the ISR to see whether the physics which it opens up will call for the improvement of this unique facility in some way. Thirdly, the PS will now be called on to serve its own physics programme, as injector for the ISR and as injector for the SPS for perhaps twenty years or more — what development of the PS this will require is not yet completely clear. Fourthly, studies on the SPS physics programme are just beginning — equipping of the West Hall for experiments at much higher energies may involve higher expenditure than the tentative figures now set aside in the Laboratory I budgets. Thus there are obvious worries about the budget figures for future years.

Scale of contributions

It is customary every three years to bring the scale of contributions from the Member States into line with changes in net national income. The CERN Convention lays down that this be done on the basis of United Nations statistics — the average of three years being taken. The scales were last fixed in December 1968 for the years 1969, 1970, 1971 from statistics based on the years 1965, 1966, 1967. Thus the scales for the next three years were expected to be based on statistics for 1968, 1969, 1970. Unfortunately not all figures for 1970 were available at the time of the Council Session and it was decided to leave the agreement of the scales until the June 1972 Session.

Elections and Appointments

The Council elected Professor W. Gentner (Federal Republic of Germany) as its President for 1972 in succession to Professor E. Amaldi (Italy) who is leaving Council to give more time to teaching and research. Two new Vice-Presidents, Ambassador E. F. Buresch (Austria) and Professor J. K. Bøggild (Denmark), were

Professor Wolfgang Gentner newly elected President of CERN Council. Professor Gentner has been associated with CERN from its origins. He led the construction of CERN's first accelerator, the 600 MeV synchro-cyclotron and organized its initial research programme. Since 1960 he has been Director of the Max Planck Institute in Heidelberg but remained in contact with CERN as a member of the Scientific Policy Committee of which he has been Chairman for the last few years.

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elected in succession to Mr. A. Chavanne (Switzerland) and Dr. G. Funke (Sweden).

The Finance Committee will retain the same Chairman as last year — M. P. Levaux (Belgium) — but the Scientific Policy Committee will see quite a few changes with Professor A. G. Ekspong as Chairman, in succession to Professor Gentner, and Professors W. Paul and P.T. Matthews as new members. New ex-officio members will be Professors D. H. Wilkinson (Chairman of the Physics III Experiments Committee), I. Mannelli (Chairman of the Electronic Experiments Committee) and F. Amman (Chairman of the Advisory Machine Committee).

Within CERN itself, Professor L. Van Hove was appointed Director of the Theoretical Physics Department and Professor H. Schopper was appointed a Member of the Directorate with the special responsibility of assisting the Director General of Laboratory I in the co-ordination of the experimental programme. Dr. C. J. Zilverschoon was reappointed Director of the Proton Synchrotron Department.

The Council noted with regret that Dr. M.G.N. Hine did not wish to continue as Director of the Applied Physics Department after the end of 1971. Both the Director General of Laboratory I and the President of the Council praised the invaluable contribution that Mervyn Hine has made to CERN during his many years of selfless work in the Directorate. Dr. G. R. Macleod, leader of the Data Handling Division in the Applied Physics Department will attend meetings of the Board of Directors.

Departure of Edoardo Amaldi

The Council concluded its business with some warm tributes to Professor Edoardo Amaldi who is leaving the Council both as its President and as delegate from Italy. It is difficult to believe that when Council next meets Amaldi will no longer be at the centre of its affairs. For so many years he has been among the leaders in formulating CERN policy and in working to convert policy into reality. Very many people have given exceptionally of their abilities and their energies for the cause of CERN but if, from among these, a handful were selected, Amaldi would be on everyone's list. Without him CERN would have been a poorer place.

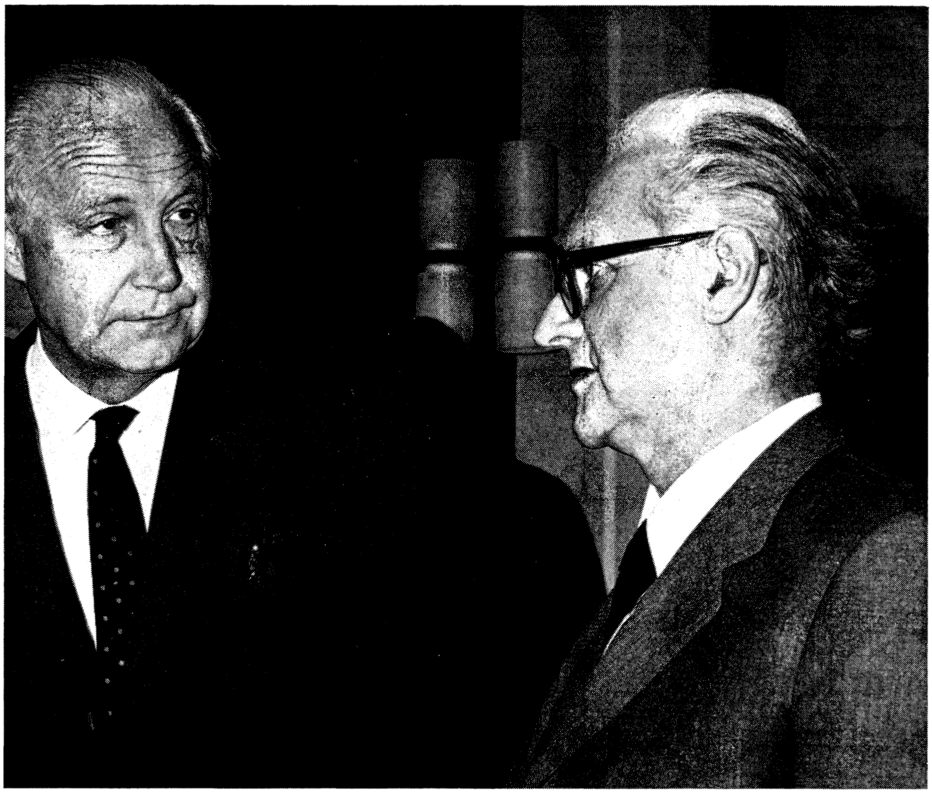
We reproduce here the tributes paid by the Vice-President, A. Chavanne, on behalf of the Council and of the Director General of Laboratory II, J. B. Adams, on behalf of CERN :

André Chavanne : ' I know that I am expressing the feelings of the entire Council in thanking Professor Amaldi. This Organization, of which he is one of the founders, owes him a great deal. By his work in the Scientific Policy Committee he has maintained and, by virtue of his scientific ability and personal competence, strengthened those bonds between the Organization and European physicists which proved indispensable during the period when difficulties were being experienced with the CERN Laboratory II project.

Professor Amaldi faced up to these difficulties with determination. Although, when we returned to our own countries, we met with varying degrees of scepticism on the part of our Governments and sometimes even of the scientists engaged in national research, he never lost heart. At a time when the great ideals which had inspired the founders of CERN — the absolute worth of fundamental research, and the importance to Europe of remaining in the forefront of high energy physics (of which it had been the cradle) — appeared to be fading, his faith inspired all of us to revive them once more and to defend them to the utmost.

Finally, when we had to press for the acceptance of a new project — the only feasible one, involving a return to this area around the Franco-Swiss border which is always ready to extend us a welcome — it was Amaldi's impartiality in the face of disappointment, his belief that everything could be explained honestly and rationally, his pleasant and friendly approach, in short, all those qualities which make him a model of the ' extra muros ' diplomat, which made it possible to solve the final problems.

Professor Amaldi is not leaving CERN — I am sure he never could — but only the Presidency of the Council, in order to devote more time to direct scientific research and the training of young scientists. He may rest assured that we shall never cease to regard him with the greatest admiration and gratitude. '



Professor Edoardo Amaldi (right) photographed during the December Council Session with Professor Jentschke, Director General of CERN Laboratory I.

John Adams : ' My first contact with Professor Amaldi was in 1952 when he visited England on the invitation of Sir Ben Lockspeiser to help persuade the British Authorities to join CERN. I was asked by Sir John Cockcroft to look after Amaldi during that visit and to show him the accelerators we had built in Harwell. I was rather young in those days and Amaldi was one of the great nuclear scientists of Europe, a colleague of the famous Enrico Fermi, and I was very nervous.

When some of. us came to Geneva towards the end of 1953 it was Amaldi who seemed the most in evidence, smoothing out the difficulties as they arose, consulting with important people in the Member States and generally masterminding the business of setting up a new organization. As Secretary-General of the provisional CERN he was a very busy man indeed and a most impressive figure to us young pioneers in Geneva. His enthusiasm and optimism infected all those about him, even apparently those remote and awful bodies, the governments of the Member States. Doors which seemed most firmly shut to lesser mortals opened invitingly to Amaldi. If some of the doors stuck a little he knew who could prise them open and if that failed there was always someone he knew who could open a window from the inside. At least that is how it seemed to us and our respect and admiration for Amaldi knew no bounds.

Inside the new laboratory he took part in all our problems. When Odd Dahl decided to stay in Norway rather than continue to lead the proton synchrotron group, it was Amaldi who looked around for a successor. When Bakker, the Director-General, was killed in an aircraft accident in 1960 it was Amaldi who helped to find a replacement to bridge the gap until a longer term solution could be found. In fact I believe he has played a leading part in finding Directors-General throughout the whole history of CERN and, what is more difficult, in persuading them to accept the job.

When new facilities were required in Europe around 1965, it was Amaldi again who took the lead both with the ISR and 300 GeV projects and he did this in a particularly characteristic way. Like all really great generals, Amaldi planned his attack on many fronts, using both direct assaults and encircling movements. Studies were set up, plans were made and massive documents fell with an impressive thud on the desks of the delegates of the Member States. Popular articles appeared all over Europe and somehow reached Ministers. But his crowning achievement was the marshalling of the forces of the nuclear physicists of Europe to form a menacing army always appearing on the horizon at the critical moment armed with more documents and inexhaustible argument. I refer, of course, to ECFA, Amaldi's secret weapon, with which he engaged in a kind of guerilla warfare against the dark forces opposing the 300 GeV Programme. As somebody said at the time, quoting a remark an English general made about his troops, ' I don't know what effect they have on the enemy, but God they terrify me '.

The hand of Amaldi is writ large over all CERN and throughout its entire history. He has occupied nearly every important position in the Organization, from Secretary-General to President of the Council. Amaldi is now leaving the Presidency of the Council, but not we trust the Scientific Policy Committee. Perhaps he feels this is an opportune time to leave since this year, under his Presidency, the 300 GeV Programme was finally approved and nobody worked harder than he for this happy event. We shall certainly miss him in the CERN Council. We shall miss his advice, his wisdom and above all his incurable optimism.

He tells us that he wants to become a full-time research physicist again. Now, as any nuclear physicist will tell you, this is a far higher position than all the important posts he has so far filled in the Organization, so he is, according to this view, moving on to higher things.

We in the laboratories of CERN must, therefore, now say goodbye to Amaldi in many of his capacities ; to President Amaldi of the Council, to Chairman Amaldi of the SPC and to General Amaldi, leader of the ECFA guerillas. At the same time, since he plans to carry out experiments at CERN in the future, we would like to say welcome to Professor Edoardo Amaldi, visiting scientist from Rome, and to wish him every success in his future career using the CERN experimental facilities, which he, more than anyone else, has brought into being. '

CERN News

'Adam and Eva' scanning and measurement equipment photographed in the course of development at CERN. Two units have been ordered by Serpukhov and two will go to the University of Mons. In the foreground are three racks of controls (including the PDP 8/L computer, visible top left). The image movement can be controlled to an accuracy of 2 μm. The computer carefully monitors the operations, both of the apparatus itself (servo-mechanisms, alarms, control desk) and of the measuring sequences (dialogue with the operator, detection of major measurement errors and possible link with a larger on-line computer).

First catch your quark

When a range of higher energies becomes accessible, one of the first experiments to be carried out is a search for the postulated quark particles. The idea of quarks as the constituents of the many particles with which we are familiar has proved a very fruitful hypothesis in trying to understand the orderly behaviour and relationships of the known particles. However, there is no convincing evidence that quarks actually exist as individual entities. They should be easy to identify since they carry a fraction (one third or two thirds) of the normal charge. But not one has been unequivocally pinned down.

It is possible that the energies accessible at our accelerators has been insufficient to 'materialize' a quark. Thus now that the very high collision energies at the CERN Intersecting Storage Rings are available (equivalent to a conventional accelerator of energy approaching 2000 GeV) several teams have mounted quark hunts with detectors installed which could reveal the elusive particle.

Our reason for returning to this familiar subject is that there appears to be a widespread rumour that one of the teams (the CERN-Munich collaboration in intersection region I-4) has seen quarks. We would be delighted to confirm this rumour but unfortunately it is not true. The team has so far shown that less than one in ten million charged particles created at small angles in proton-proton collisions at the ISR has fractional charge. Also a Saclay-Strasbourg team has a cross-section limit for the production of quarks in the ISR of less than 1 μb. The teams have not yet been published and discussion of their results should wait until they have moved into print.

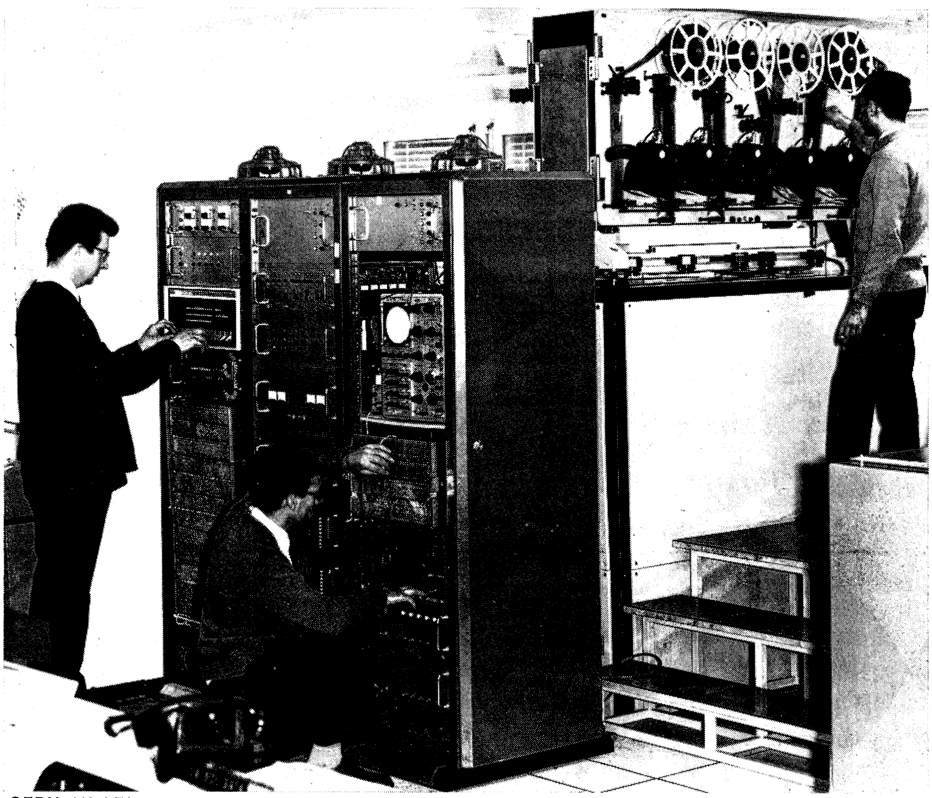
Adam and Eva for Serpukhov

The scanning and measuring equipment known as 'Adam and Eva' (the prototype of which was produced in 1970 — see vol. 10, page 229) was discussed with Serpukhov from its initial design. Serpukhov has been interested in it for use with the films from the hydrogen bubble chamber, Mirabelle. In October 1971, these discussions led to the signature of a contract for two of these units.

The task of building the equipment was given to two French firms: CEFAL in Evian for the mechanical, optical and electro-mechanical components, and TITN in Fresnes, for the electronics. Before the final order could be placed, an export licence had to be obtained for the PDP 8/L computer, made in the USA. The permit was obtained in January 1972 and the two units should be delivered one in 12 and one in 15 months from now. Serpukhov may possibly order several additional units.

Plans are being made to receive technicians from Serpukhov at CERN to familiarize them with the equipment. Moreover, the University of Mons, in Belgium, which is also interested in the measurement of Mirabelle photographs, has decided to buy two Adam and Eva units which have already been built by the CERN Central and DD workshops. One of these will very shortly be leaving CERN and should be ready to operate at Mons in February.

A considerable number of high quality photographs has already been taken in Mirabelle, during a run which began in October 1971, with incident protons of 70 GeV/c. The experiments to be fed by the r.f. separated beam line developped by CERN (see vol.



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Inside the new 'Centre d'Apprentissage'. A barrack has been converted to provide a range of facilities used in apprentice training. The apprentices will be together at the Centre for eighteen months of their period of training.

11, page 216) are scheduled to be under way during the summer of 1972.

New home for CERN apprentices

On 9 December a modest ceremony was held to inaugurate the ' Centre d'Apprentissage ' at CERN. The ceremony brought together the relevant people from CERN (including those responsible from the Training and Education Section and the apprentice supervisors), the apprentices themselves and representatives of the Geneva authorities concerned with apprentice training. The ' Centre d'Apprentissage ' is a barrack which has been specially converted to provide a range of training facilities (workshop equipment, etc.) and which enables the apprentices to be together for a considerable part of their programmes.

Apprentice training began at CERN in 1966 (see vol. 7, page 8), following an initiative of the Geneva ' Département du Commerce et de l'Industrie ', and a small number of young people began training to become mainly laboratory assistants (physics) or mechanics/electronicians. After several years of experience, and in continued consultation with the appropriate local authorities, a revision of the training programmes was carried out last year which led to the creation of the ' Centre d'Apprentissage '.

It is now possible for the apprentices of both categories mentioned above to spend their first sixteen months at CERN following common programmes at the Centre where equipment is installed for workshop practice, electrical and electronic training, and technical design, supplementing the theoretical work. The two categories then split — the laboratory assistants do another year and a half covering such topics as surface treatment, chemistry, glass blowing, special workshop techniques (work in plastics), vacuum techniques, etc... as well as gaining some experience of working in a physics group ; the mechanics/electronicians do another two and a half years mainly of practical work (electronics, etc.).

At the end of their training the apprentices take examinations (the C. A. P. Suisse) and are then free to move into industry or scientific laboratories in Geneva or other Member States or to apply for a position at CERN itself after possibly several years experience elsewhere. Though on a modest scale, the apprentice scheme is one way of using the wide range of expertise at CERN in the training of the young people of the region.

PS shutdown

The annual long shutdown of the 28 GeV proton synchrotron began on 3 January and is scheduled to continue until 16 February. As usual, the time is fully occupied with repairs and alterations and there will be no time to spare. The work to be done includes the dismantling and reassembling of one-third of the machine straight sections, moving eight magnets, installing a large number of hydraulic lines and of cables. Our list will be limited to some of the main jobs.

Linac : Since most of the work on the linac concerning the improvement programme was carried out during the previous shutdown (see vol. 10, page 348) there are fewer alterations this year. They include — installing the second part of the new injection line to the PS ; replacing the power supply cables for the amplifier final stages by rigid coaxial lines in order to improve reliability ; perfecting a slow beam-chopper between the preinjector and tank 1 in order to produce pulses in the beam (three in 100 μs) to help the distribution of the beam over the four rings of the Booster.

PS ring : a) For the Booster-PS injection line there will be installation of beam transfer components (quadrupoles, dipoles and detectors) and injection equipment (septum magnet and fast deflector). In addition new components for the injection are needed in the PS itself (four bump magnets, three sections of enlarged vacuum chamber and a triggering system linked to the magnetic field). Two PS magnets have to be rearranged so that the transfer line can pass into the ring ;

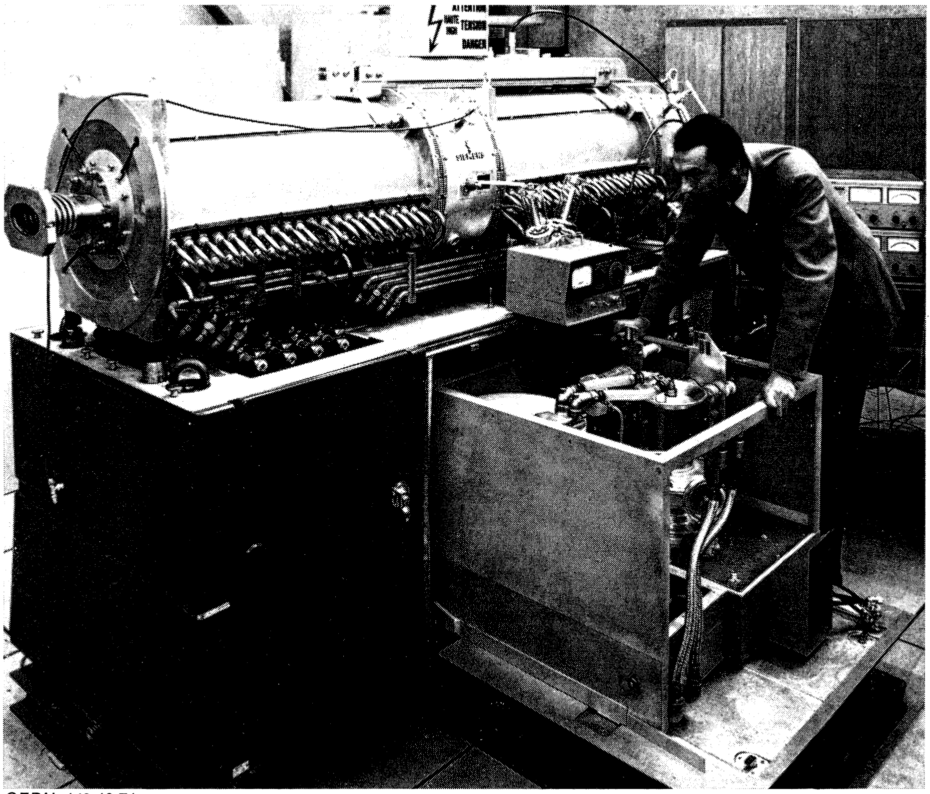
b) Slow ejection to the West Hall will be added to the existing ejection facilities to provide beams for experiments with the Omega spectrometer. This requires the installation in straight section 16 of a septum magnet for use with both types of ejection. The whole slow ejection system comprises three septa (a 0.1 mm thick electrostatic septum in section 83, a 1.5 mm thin septum beam in section 85 and a 6 mm septum in section 16). The beam bump needed to clear the first two septa, will be given by six magnets which are yet to be installed and which will require the vacuum tank in four magnets to be widened ;

c) The hyperon bubble chamber, HYBUC, in the North Hall will be fed by a new beam, k 16, which will be drawn from an internal target in straight section 11. This involves moving an accelerating cavity and changing two magnets so that there is room for the beam to leave the machine ;

d) Magnet 6, which has been damaged by radiation and has been in use since July with only half its pole-face windings, is being replaced by a new one ;

e) Fifteen dipoles to manœuvre the

The first of the new accelerating cavities for the PS which will be installed in straight section 66 of the ring during the present shutdown of the machine. The cavity will provide a peak r.f. voltage of 20 kV which is twice that of the previous model. After a test period (during which the old cavities will be left untouched so that they can be brought back into action if needed), the fourteen existing cavities will gradually be replaced by ten new ones.
This progressive replacement will avoid problems which might be encountered in replacing the cavities en bloc.



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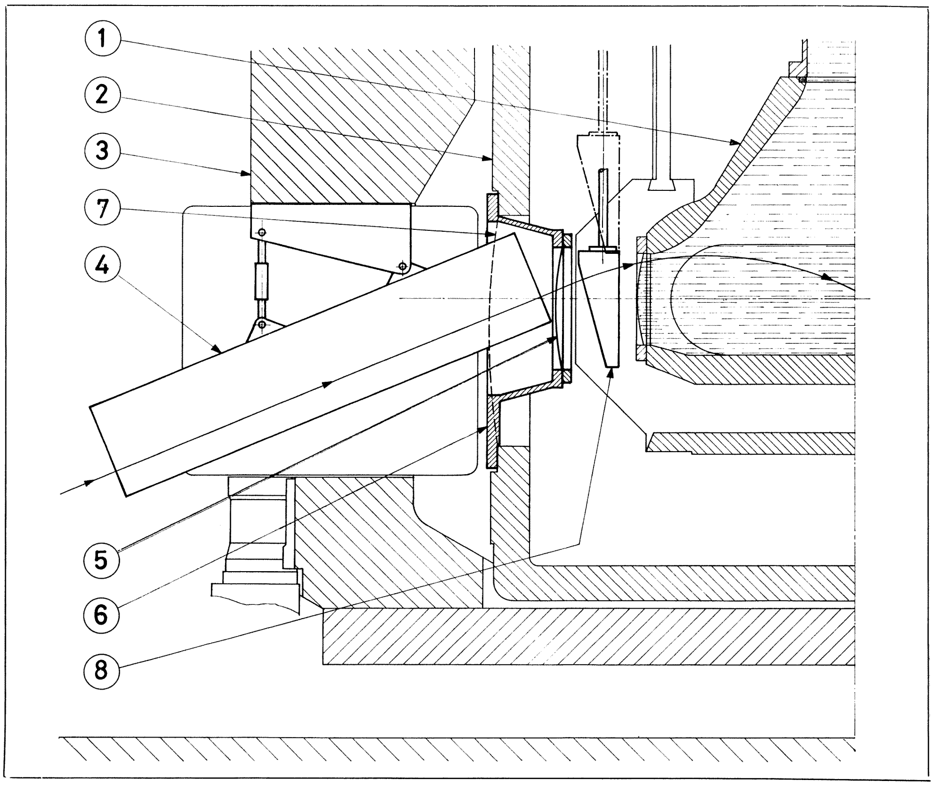
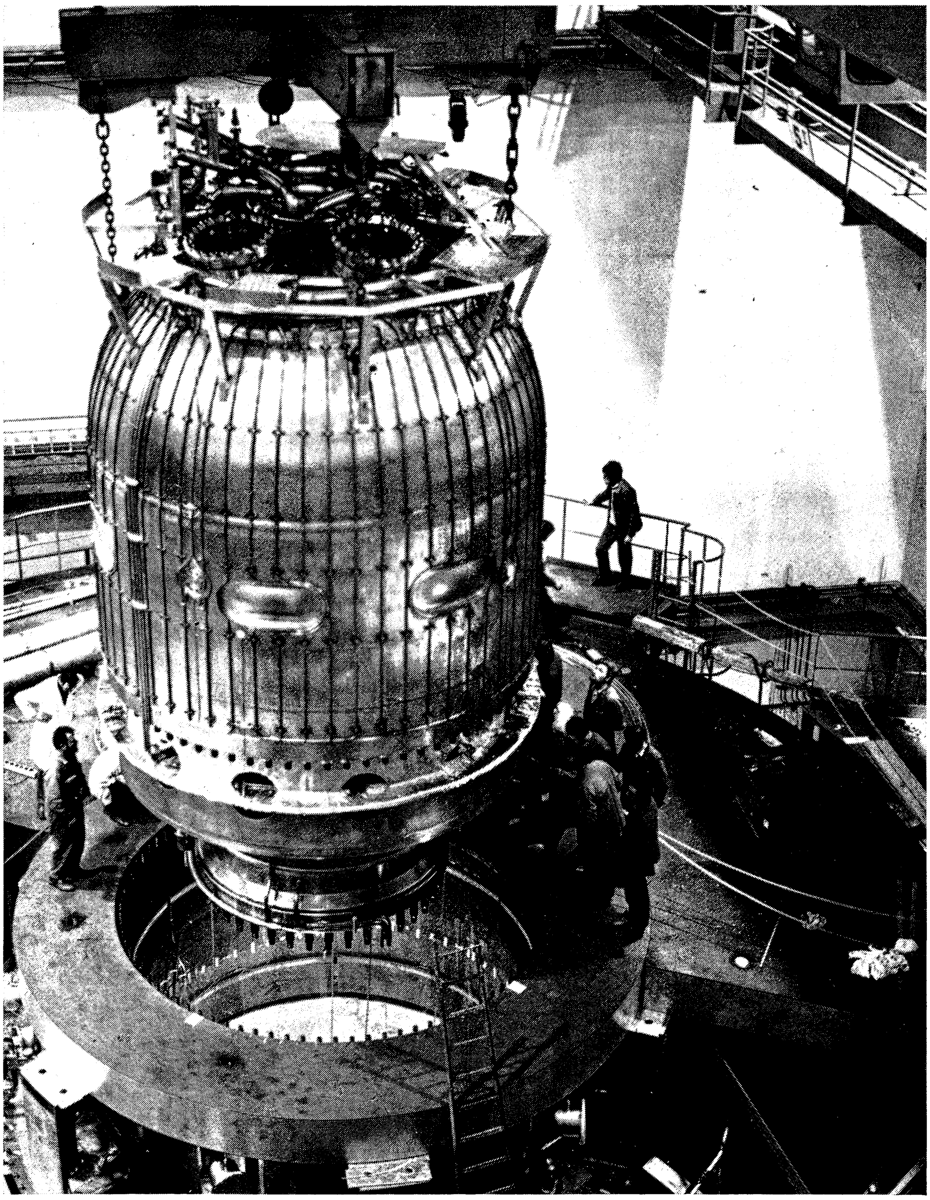
A drawing of the major modifications to the 2 m hydrogen bubble chamber during the PS shutdown. A re-entrant window (6) is to be installed in the vacuum tank (2) to allow the superconducting field shield (4) to be positioned close to the chamber body (1). The dotted line (7) shows the position of the previous window. Indicated in addition is the shielding (3), new window (5), and a mobile absorber (8) which will ensure that particle trajectories stay within the chamber volume. The modifications will enable the chamber to be used with very low energy particles.





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Installation of the chamber body of the 3.7 m hydrogen bubble chamber, BEBC, in its vacuum tank just before Christmas. The body, equipped with its heat exchangers and two fish-eyes which will be used in the first series of tests, is being lowered through the top of the shielding which surrounds the chamber.

high energy beam will be installed. Their purpose will be, for example, to share the beam between various targets or between the targets and the ejections ;

f) The first of the new accelerating cavities, designed particularly to cope with the more intense beams which will come from the Booster, will be installed ;

g) The vacuum tank close to magnet 60 will be widened to give improved slow ejection using the one third resonance.

Experimental Halls : In the North Hall the only change is that concerning the beam feeding the HYBUC chamber (it will be moved and shortened). In the South Hall the q10 2.5 GeV/c unseparated beam is being converted to a low energy kaon beam with electrostatic separators. In the East Hall the high energy p4 beam is undergoing considerable improvements involving a re-arrangement of the b17 beam. No immediate changes are planned for the beams feeding the 2 m bubble chamber.

Neutrino beam-line : Since Gargamelle is to be fed with antiprotons for a proton-antiproton annihilation experiment due to begin when the shutdown is over, a beam by-passing the neutrino shielding is being installed.

Work on the 2 m bubble chamber

In 1972, the 2 m hydrogen bubble chamber will be closed down for more than four months (January to May) for a general overhaul.

Maintenance operations involve the complete dismantling of the vacuum chamber, the optical system, the expansion system and transfer lines, as well as the cleaning of the chamber's windows. Major alterations are : modifications to the vacuum chamber, the fitting of a beam absorber, the fitting of expandable seals to the windows of the safety vessel, the addition of a new flash-unit cooling system, and the installation of a system for measuring the luminosity of the flashes. The alterations to the vacuum chamber are required in order to be able to fit, at a later date, the superconducting field shield described in vol. 11, page 155. This shield has to be fitted as near as possible to the chamber body to enable low energy particles to pass through the chamber's magnetic field and enter the hydrogen.

In an attempt to improve the definition of the photographs, a set of windows of better optical quality will be added to the vacuum and safety chambers on the camera side. The windows of the safety chamber (where the temperature is about 30 K) will be protected against leaks by special pure indium seals combined with expandable diaphragms ; these will reduce mechanical stresses and enable the windows to preserve their optical efficiency.

To improve the service-life of the flash units and ensure more consistent lighting, the flash discharge tubes, which are at present air-cooled, will be enclosed in a glass container in which demineralized water will circulate. As a result, the temperature distribution in the tube will be improved. The advantage will be particularly noticeable during multi-pulsing of the chamber. At the same time, trials will be made with a new system for measuring the flash intensity. If the results turn out as expected, the system could be used as a basis for regulating the luminosity in the chamber by means of the control computer.

The 2 m chamber will have thus been given a face-lift to preserve its vigour which was very much in evidence last year. 5 250 000 photographs were taken (four million during double pulsing). This brings the total number of photographs taken since its first operation in 1965 to 19 328 000.

Conference at CERN and CERN School

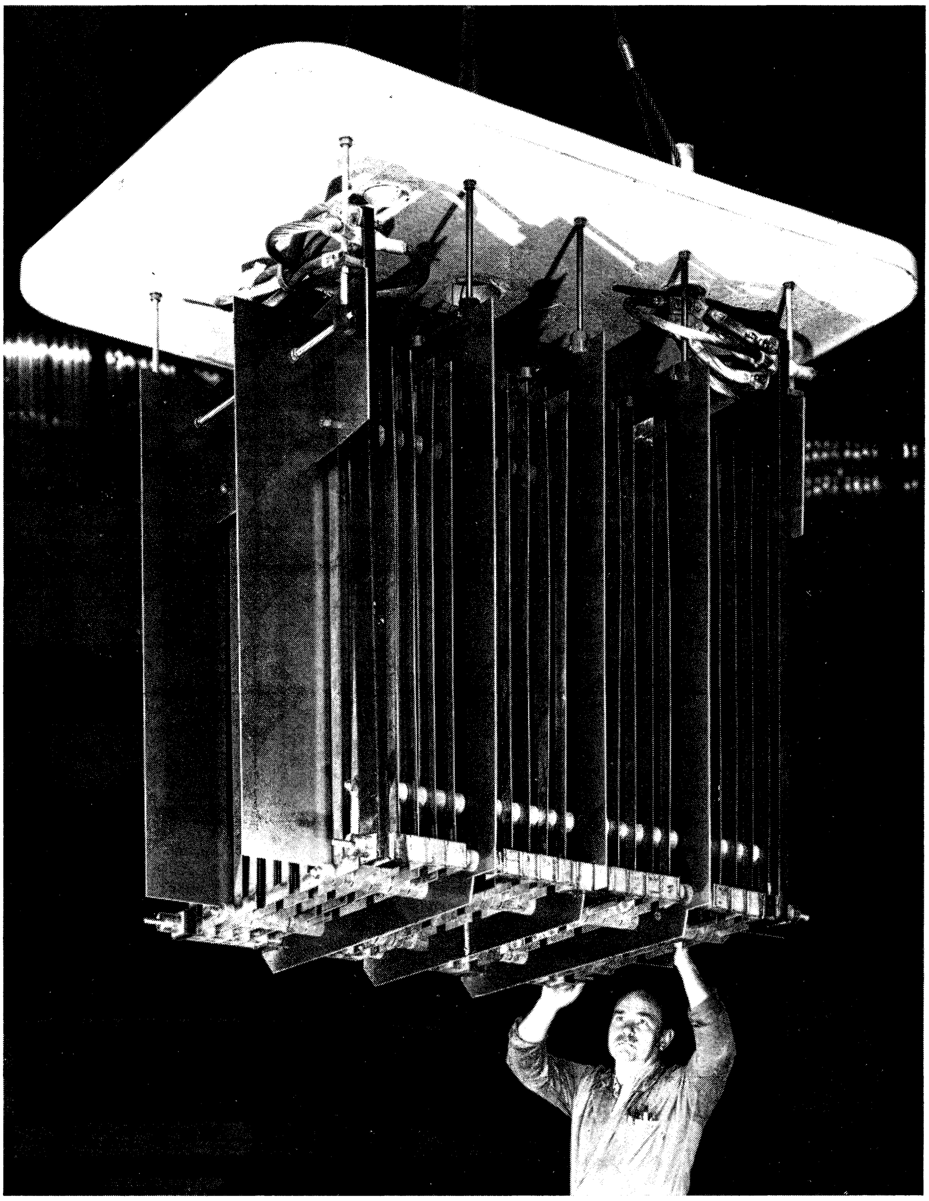
The First European Conference on Computational Physics will be held at CERN from 10-14 April under the title 'The Impact of Computers on Physics'. The Conference is organized by the Computational Physics Group of the European Physical Society.

The major part of the programme will be devoted to invited papers reviewing the effect of the advent of the electronic computer on physics research in the past ten to twenty years and should help to identify those areas of physics where computation may become critical in future years. A broad range of applications of computers in pure and applied physics will be covered. Correspondence concerning the Conference should be addressed to — Scientific Conference Secretariat (Miss D. A. Caton), CERN, 1211 Geneva 23, Switzerland.

On 10-23 September the 1972 CERN Computing and Data Processing School will be held at Pertisau in Austria. Like the first School of this type, held in 1970 at Varenna in Italy, the programme of the 1972 School is designed to give the young experimental physicist the opportunity to relate his empirical use of computers to the wider conceptual frame-work of computer science, and to give the young computer scientist an opportunity to learn something of the wide range of computer applications in high energy physics.

The school is open to high energy physicists and computer scientists from the CERN Member States or Laboratories closely associated with CERN. The number of participants will be limited to about 75 and application forms will be available shortly. Correspondence concerning the School should be addressed to — Scientific Conference Secretariat (Miss D. A. Caton), CERN, 1211 Geneva 23, Switzerland.

One of the BEBC protection resistors whose purpose is to dissipate the energy (up to 750 MJ) stored in the superconducting magnet of the bubble chamber should any fault develop which sends the superconductor 'normal'. The resistors are now installed in the power supply circuit of the magnet.



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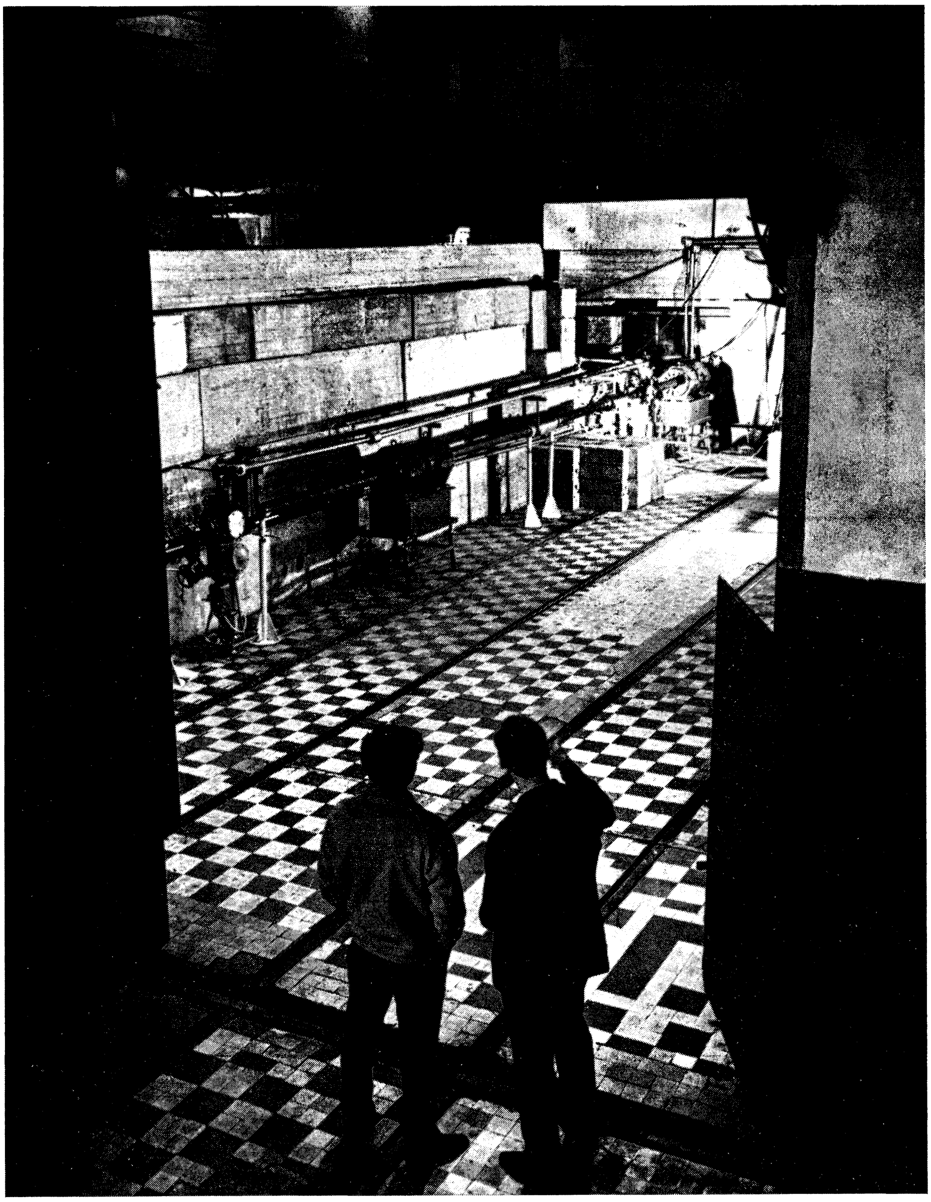
Around the Laboratories

Part of the beam transport system which conveys xenon ions from one cyclotron to another in the tandem arrangement used to accelerate heavy ions at Dubna.

(Photo Dubna)



DUBNA
Acceleration of xenon ions

A beam of xenon ions has been accelerated to an energy of about 900 MeV at the Joint Institute for Nuclear Research, DUBNA, by means of two cyclotrons linked together in a tandem system.

The ions were accelerated in several stages. In the first, ions with a relatively low charge (8 or 9 times ionized), obtained from an arc-type ion source, were accelerated in a cyclotron with a pole diameter of 310 cm, operating in the third harmonic mode, up to an energy of about 1 MeV/nucleon. The beam of ions was then extracted and sent along a 70 m beam-line to be injected into an isochronous cyclotron with a pole diameter of 200 cm. Inside this cyclotron was a 0.5 μm aluminium foil to strip more electrons from the xenon ions. After passing through the foil, the ions acquired a charge of 27 to 30 (depending on their energy) and were subsequently accelerated up to full energy. The ion beam intensity was 3×10^9 particles/second for Xe^{+27}_{136} and 2×10^8 particles/second for Xe^{+30}_{136}. Work is in progress to increase these intensities.

In the first physics experiments, measurements were made of gamma-activity of the products of nuclear reactions occurring in the interaction of the accelerated xenon ions with nuclei of various elements. The radioactive isotopes produced in reactions during irradiation of a magnesium target were identified by measuring the gamma-transition energy and half-life. It was shown that, when accelerated xenon ions interact with nuclei of heavy elements, such as tantalum, bismuth or uranium, the cross-sections of the transfer reactions of one or several nucleons substantially exceed the cross-sections of similar reactions with much lighter accelerated ions.

A programme of experiments is being developed in which use is made of radiochemical and spectrometric methods of isotope separation. This programme has three aims : 1) the synthesis of superheavy elements in the range of the theoretically predicted island of stability (elements of atomic number Z = 110 to 116) ; 2) the synthesis of new neutron-rich isotopes of transuranic elements such as Californium-255 and Californium-256 ; 3) the synthesis and study of the characteristics of neutron-rich isotopes far away from the region of beta stability over a wide range of nuclear masses.

At the present time, priority is being given to the first of these three aims. More detailed information on the subject of the synthesis of new elements

* *Late news : In the last week of January beams were accelerated to transition energy in the Main Ring.*

and isotopes with the use of beams of very heavy ions such as xenon, was given by G. N. Flerov in a talk at CERN in September of last year.

BATAVIA Commissionning progress *

A detailed review of progress in bringing the 200-500 GeV accelerator into action at the National Accelerator Laboratory, Batavia, was given in December in a letter from R. R. Wilson, Director of the Laboratory, to the NAL Users Organization. Since the commissioning of the machine at Batavia is of great interest in the high energy physics world and since it is three months since a report on this subject appeared in CERN COURIER, we reproduce here some information largely based on the letter.

The 200 MeV linac has accelerated a beam of 100 mA, well above its design intensity, and, though reliability can still be improved, it is feeding the 8 GeV Booster with an efficiency of better than 90 %. The Booster is designed to feed the Main Ring in turn with twelve pulses, each 2 μs long and containing about 4×10^{12} protons, in 0.8 s (i.e. operating at a frequency of 15 Hz). This intensity requires four turn injection from the linac and this injection system has been successfully tested. However, during commissioning, one turn injection is used and a beam of 10^{11} protons per pulse is being accelerated in the Booster. Four turn injection, better tuning of the beam-transfer line from the linac, and better alignment and tuning of the Booster magnet system should give the design pulse intensity.

The Booster problems centre on the r.f. accelerating system. There were flaws (insulation pierced by steel slivers) in the rather complicated biasing coils of the ferrite tuners and the units have had to be rebuilt. There are also mechanical troubles such as water leaks which are still to be sorted out. Sixteen cavities were scheduled to be installed with fourteen of them providing the necessary accelerating voltage per turn to achieve 8 GeV in 0.06 s. At present all sixteen are needed to accelerate to 8 GeV and the peak energy has therefore been temporarily lowered to 7.2 GeV so that two cavities can remain on standby. Improvement of the performance of the r.f. amplifier is being worked on at an independent test stand in the Booster gallery. Two additional cavities have been ordered also to be installed in the ring if improvements to the present system do not bear fruit.

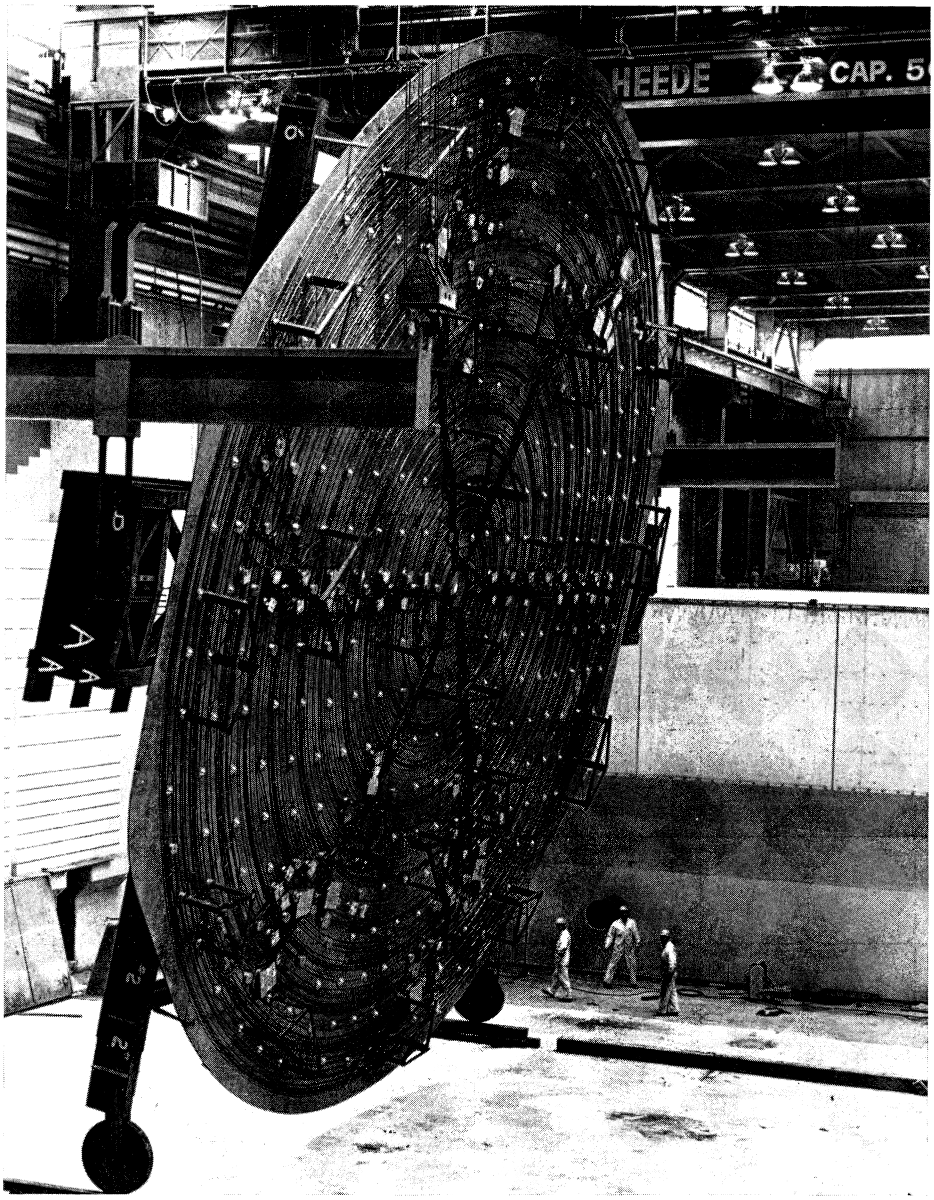
Although the Booster magnet is pulsed at 15 Hz, the r.f. is run at 1 Hz at present since one pulse per second is all the Main Ring can yet take. This also keeps the radioactivity down. There is no operating experience of feeding twelve pulses in 0.8 s and, before this can be tested, the power transformers of the rectifier for the r.f. amplifier has to be brought to design specification. The secondary coil moved slightly when the protective crowbar circuit fired, leading to insulation failure. Temporarily, a resistor in series is limiting the coil movement but the resistors cannot be operated at more than 1 Hz (they are therefore being replaced by a water-cooled version). The transformers are being rebuilt with properly braced secondary coils and others have been ordered as spares.

The main stumbling block to operation of the accelerator is the performance of the Main Ring magnets. As reported in the October issue of last year, condensation from hot humid air in the cold machine tunnel soaked the magnets and revealed insulation defects. The normal peak voltage to ground for field levels equivalent to 200 GeV is about 250 V and the magnets were checked at 2.5 kV before installation. Single magnets, magnets in the prototype tunnel and magnets in the first completed sixth of the ring, all performed satisfactorily up to high field levels. The magnets were not, however, tested after being submerged in water and it was water which found the faults. Sixty magnets were lost due to spark breakdown and many others revealed low resistance to ground.

The problem is being tackled by warming and drying out the tunnel with mobile air-conditioners and heaters already installed in the ventilation system. But, more importantly, it is necessary to completely dry out magnets by removing them from the ring and baking at 90° C under vacuum for many hours. This usually restores the resistance to ground and the magnet is then vacuum impregnated to fill in the cracks before being fed back to the Main Ring. A total of 275 magnets have been recycled and the Main Ring magnet system now regularly holds off 700 V (and some parts 1 kV). Recycling will continue until design specifications have been achieved.

The magnet power supplies have troubles due to imprecise computer controlled timing of the thyristors giving voltage spikes. This has been temporarily brought under control by running supplies in parallel rather than series and installing voltage and current cutouts. The Main Ring has since been pulsed up to field levels corresponding to 120 GeV using only thirty of the sixty power supplies and no magnets have failed due to spark breakdown under these conditions.

Obstacles in the Main Ring vacuum chamber are a possible cause of decay of the intensity of a coasting beam and a pneumatically driven



The huge lid of the vacuum tank of the TRIUMF cyclotron (being built on the campus of British Columbia University, Vancouver, Canada) being turned for its final cleaning. The triangular projections are the supports on which the lid rests on the floor. The pips, which are liberally sprinkled over the surface, take the tie rods coming from the support structure to prevent the vacuum tank collapsing under atmospheric pressure (a load of about 2700 tons) when it is pumped out.

(Photo TRIUMF)

device has been developed to sweep the chamber. There has been one complete pass around the ring (over 6 km of vacuum tube) which yielded debris including slivers of thin steel which can find their way into the tube when a magnet is cut out of the ring. More sweeping of the chamber may be needed.

A more recent report indicates that the strong sextupole component in the remanent field of the bending magnets, may be the source of the trouble. Besides amplifying the closed orbit distortion, and therefore reducing the available aperture, it causes beam blow-up. Extra correction sextupoles are now being installed to try to cancel out this effect.

There has been a survey of magnet positions and the tunnel now seems stable. The focusing magnets have all been precisely aligned and the same procedure is under way for the bending magnets so as to ensure that the closed orbit will continue to be contained in the magnet aperture at high field levels.

There are sufficient r.f. cavities in operation to provide 50 GeV/s acceleration. The components of the ejection systems have been temporarily removed and will be reinstalled when acceleration to high energies has been mastered. Beam-transport to the Neutrino Laboratory has been successfully tested and development of that experimental area is well advanced. (Operation of the 30 inch bubble chamber is reported on page 16.) However, development of the Proton Laboratory and the Meson Laboratory has been suspended to throw more effort onto the commissioning of the accelerator. The aim now is to try to beat the original five year schedule and to have a high energy beam before 1 July 1972.

Professor Wilson concluded his letter to the Users with the following statement : ' The group of physicists, engineers and technicians at NAL, although not large, is knowledgeable, is hard working, is utterly determined. They have designed and built the accelerator in a remarkably short time. I am serenely confident in their ability to bring it into operation. It will be a fine accelerator and you will make beautiful physics with it '.

KARLSRUHE New refrigerator and cryostat

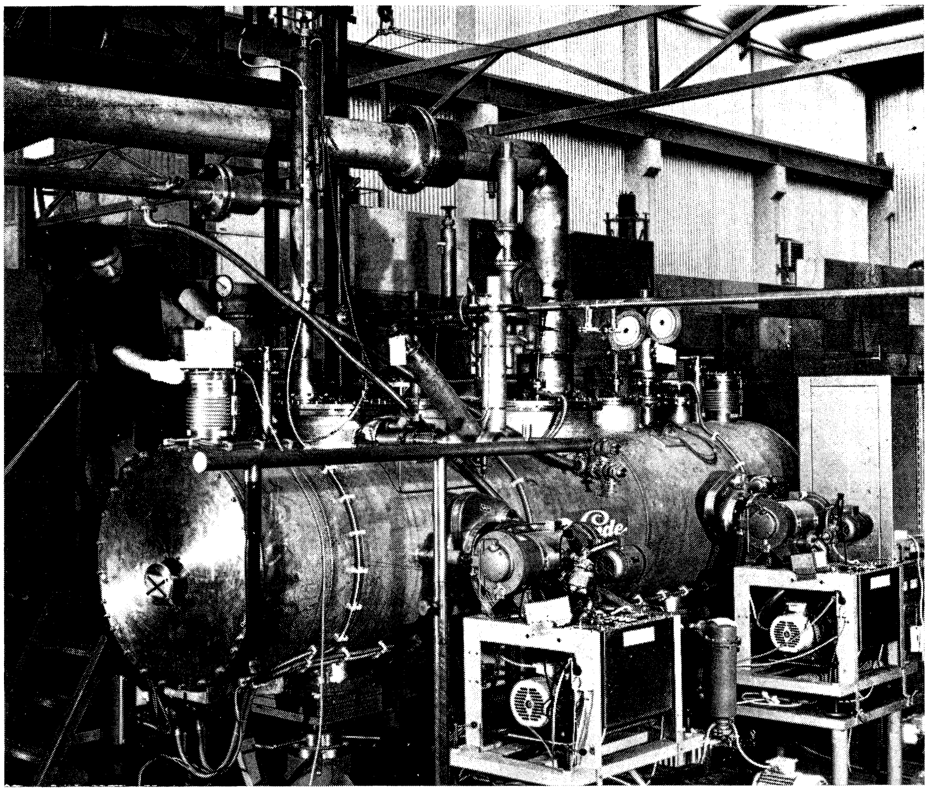
The first of two new helium refrigerators (ordered for large-scale experiments of the superconducting linear accelerator and r.f. separator projects, and also for pulsed magnet development) has been successfully tested and has given several thousand hours of operation at the Institut für Experimentelle Kernphysik, Karlsruhe.

The refrigerator was built by Linde AG, Munich. It has a capacity of more than 355 W at 1.8 K or, alternatively, about 400 W at 4.4 K (the equivalent of 110 l/h liquefaction rate). Simultaneous refrigeration (or liquefaction) at the two temperature ranges is possible within the limit of 400 W capacity. The plant is thus rather flexible for use with different experiments and for liquid helium production for the laboratories. The cool-down time is 8 to 10 h ; it works without liquid nitrogen precooling. With 355 W at 1.8 K operation the power consumption is about 720 kW, which gives an overall efficiency of 8.2 % of the carnot efficiency.

The principle of a usual 4.4 K Claude-process, with two oil lubricated expansion turbines in series, is modified for refrigeration below atmospheric pressure by an additional pump loop for the low pressure

The 4 m long cryostat intended for a superconducting r.f. separator being developed at Karlsruhe for use at CERN. Successful tests on the cryostat and on new refrigeration plant were successfully carried out towards the end of last year. Vacuum insulated helium lines can be seen going off to the refrigerator.

(Photo Karlsruhe)



helium. For the 1.8 K experiments a set of eight Roots pumps reduces the vapour pressure of the helium bath in the cryostat to 12.5 torr by pumping the helium through the heat exchangers to the suction side of the compressor. The design of the low pressure exchanger was a major problem because of the lack of data for helium under these conditions. Another problem for long term operation was to avoid oil and air contamination of the helium gas ; this is done by using a dry compressor and oil free compression.

Up to now, two different experiments have used the plant. First, a copper dipole model of a superconducting bending magnet, 1 m long, was operated at 4.4 K to measure the heat transfer in the coolant passages. For forced cooling of the coil, the full capacity of 400 W has been utilized for d.c. and pulsed operation.

Another experimental run was made with the first 4 m cryostat for the r.f. particle separator under development at Karlsruhe for use at CERN. A full-scale niobium deflector can be tested at 1.8 K with this cryostat which has been developed in cooperation with Linde AG. Connected to two 10 m long vacuum-insulated lines, the cryostat has been cooled down to 1.8 K and filled with superfluid helium. Using a heater to simulate r.f. losses in a superconducting structure, an effective heat dissipation of 355 W under steady-state conditions has been measured. The pressure, corresponding to the temperature, could be controlled within 0.1 torr, (equivalent to better than 5×10^{-3} °K). The refrigeration capacity at the output of the refrigerator has been estimated to be in the range of 370 W. After the satisfactory operation of the refrigeration circuit, the cryogenic equipment is being brought into action for the first test run of the r.f. deflector structure at high power levels.

RUTHERFORD
Physics with track sensitive target

The track sensitive target facility which we described last month (page 357) following its successful operation in the 1.5 m chamber at the Rutherford Laboratory, combines the advantages of the hydrogen and heavy liquid chambers. Beam particle interactions occur in a target region of pure hydrogen so that the advantages of interaction with a free proton and simple production kinematics are preserved. It is surrounded by heavy liquid (neon-hydrogen mixture) which provides efficient conversion of gamma rays, arising from π°, η°, Σ° decays, into electron-positron pairs. Thus one of the principle disadvantages of the hydrogen/deuterium bubble chamber — the inability to study final states with more than one neutral particle — is overcome.

The neon-hydrogen mixture is also an excellent electron detector because of the characteristic bremsstrahlung energy loss of electrons in the high Z medium. The system can therefore be used to recognize and, because of the hydrogen production kinematics, to reconstruct beta decay events. Finally, the range of stopping particles in the heavy liquid allows accurate momentum measurements. Good mass resolution in missing mass experiments can be obtained outside the Jacobian peak region with the additional advantage that the decay products are detected.

The physics programme using the track sensitive target will begin with a study of 4 GeV/c π^+p interactions of which one was shown in the photograph in the last issue. Particularly interesting channels are :

1) $\pi^+p \rightarrow \Delta^{++}\pi^+\pi^-\pi^\circ$ where the H meson was originally reported in the $\varrho\pi^\circ$ combination at 960 MeV and later discredited because of possible confusion with the $\eta \rightarrow \varrho\gamma$ decay. The observation of one or two gammas associated with the H peak should clarify this situation.

2) The study of the $\pi^\circ\pi^\circ$ system in $\pi^+p \rightarrow \Delta^{++}\pi^\circ\pi^\circ$. For this study a neon-hydrogen mixture with about 80 molecular % of neon, corresponding to a radiation length of 35 cm, will be required to improve the three or four gamma detection efficiency.

3) The study of the A2 mass spectrum in $\pi^+p \rightarrow pA_2^+$ where the range of the recoil proton is measured.

Operation with deuterium in the target and about 93 molecular % neon in the chamber (radiation length 29 cm) will be attempted during 1972. An experiment has been proposed by an Oxford group to study $\pi^+d \rightarrow pp_s\pi^\circ\pi^\circ$ at 2.3 GeV/c to further investigate the $\pi^\circ\pi^\circ$ system.

Most of the members of the Argonne group responsible for the 30 inch hydrogen bubble chamber pose next to their baby after it had been brought back into operation at Batavia in November.

Below is one of the first pictures from the chamber working in its new home ; it records a cosmic ray track. A long series of experiments are already lined up for the chamber when the accelerator provides its high energy beams, some of them involving hybrid operation in conjunction with counters and spark chambers.

A University College London group has proposed a study of K^-p interactions in the energy range 0-900 MeV/c to separate the $\Lambda^0\pi^0$, $\Sigma^0\pi^0$, $\Lambda^0\pi^0\pi^0$ channels and this is coupled with a possible study by a Rutherford group of sigma minus beta decay from polarized Σ^- produced via the S-channel (about 400 MeV K^-) and from Σ^- at rest. These experiments required a new low energy beam-line which is under consideration. The K9 beam now feeding the chamber can deliver K^- in the range 1.8 - 2.8 GeV/c, K^+ 1.7 - 2.9 GeV/c, $\bar{p}$ 1.9 - 2.6 GeV/c, π^+ and π^- 0.8 - 4.5 GeV/c, p up to 7 GeV/c.

European groups are welcome to make use of this facility which has been developed as a Rutherford/CERN collaboration. In the coming years it is hoped that track sensitive targets will operate in the 3.7 m chamber, BEBC, at CERN. The study of high energy hadron interactions where multi-neutral final states account for a large fraction of the total cross-section (about 80 % at 100 GeV/c) will clearly benefit from an efficient gamma detection system.

BATAVIA 30 inch chamber in operation

The 30 inch hydrogen bubble chamber originally constructed at MURA has been reassembled at Batavia and was brought into operation again in November.

For a comparatively small chamber, the 30 inch has had a newsworthy life. It first operated at the Argonne Zero Gradient Synchrotron in April 1964. Major features are a very high precision optical system and high magnetic field (3.2 T). Its multiple pulsing capabilities were used in 1966 when two pictures were taken per ZGS cycle. By November 1968 this had been extended to five pictures per cycle. In August 1968 the ten millionth picture from the chamber was clocked up. The following year after some modifications it was used for an experiment by a Wisconsin team in a 'hybrid' arrangement with counters and spark chambers. It could be used in either triggered or tagged mode. When the time came in April 1971 to transplant the chamber to Batavia it had taken almost 14 million pictures for over 50 experiments.

All these properties are now available for use with very high energy beams from the 200/500 GeV accelerator at Batavia. Argonne has been responsible for the speedy reassembly and will operate the chamber during the first year of experiments.

Eight experiments (each collecting 50 thousand pictures) are scheduled with the chamber operating as the sole detector in a series of surveys of interactions with proton and positive and negative pion beams at the newly accessible high energies. (The teams will include scientists from Argonne, Batavia, Berkeley, Brookhaven, California, CERN, Davis, Michigan and Rochester.)

The chamber will then be incorporated in a hybrid set-up with wide-gap optical spark chambers for a systematic study (involving 450 000 pictures) of multiparticle interactions. This experiment will be an Argonne, Iowa, Maryland, Michigan collaboration with participation from Duke, Notre Dame, Purdue, Toronto and Wisconsin. Following that another, more sophisticated, hybrid set-up using multiwire proportional chambers may be developed (a feasibility study is planned).

Retirement of Professors Kowarski and Preiswerk

At the close of the December Council Session, the retirement of two of CERN's founder members (Professor Lew Kowarski on 1 March and Professor Peter Preiswerk on 1 February) was marked by tributes from Professor Edoardo Amaldi.

1. Professor Kowarski.

2. Professor Preiswerk.

Professor Kowarski

Professor Kowarski was born in St.-Petersburg (now Leningrad). In 1923, he began his studies in Belgium and continued them in France where he qualified as a chemical engineer in 1928 at the University of Lyon. For the next nine years he was technical secretary and then design engineer in an industrial firm ' Le Tube d'Acier ' and at the same time did research in biochemistry at a hospital laboratory, in molecular physics (for which he received a doctorat ès sciences under Prof. Jean Perrin) and finally in nuclear physics (under Prof. Joliot at the Laboratoire Curie).

In 1937 Joliot moved to Collège de France and Kowarski received an appointment there half-time as Joliot's personal secretary and half-time as a research worker. In 1939, together with H. von Halban and Joliot he performed the crucial experiments which proved that neutrons were emitted in the fission of uranium. Six months later, they produced the first proven nuclear chain reaction.

When war broke out, Halban and Kowarski took the world's entire stock of heavy water (which they had received from Norway for their experiments) and their important experimental records to England. Continuing their research at Cambridge University they produced the first strong evidence of the feasibility of a controlled nuclear reactor. Four years later, when the first nuclear reactor outside the USA was started in Canada, Professor Kowarski was in charge of design and construction.

After the completion of this task in late 1945, he returned to France to become Director of the scientific services of the Commissariat à l'Energie atomique where, among other duties, he was in charge of building the first two French reactors — Zoe and EL 2. He was advisor to the French delegation to the United Nations Commission on the control of atomic energy. When the idea of CERN germinated, Professor Kowarski was a party to the first informal development of the Organization. He was chosen as Director of the Laboratory Group in 1952 responsible for planning the site, first buildings, administrative methods, libraries, instrumentation, etc. In 1954 when the permanent Organization came into being, he moved to Geneva as Director of the Scientific and Technical Services Division and supervised the launching and early years of operation of such activities as workshops, electronics, track chambers, cryogenics, health physics, documentation, computers and data processing.

In 1960, the Data Handling Division was formed with Prof. Kowarski as Leader, to cope particularly with the growing use of computers and of automatic devices for scanning and measuring bubble chamber and spark chamber film. (One of these devices, ' Luciole ', was initiated by Professor Kowarski himself and he has also been involved in the conception and development of the Hough-Powell Device.) He has had a special position supervising the long-term development of data-processing in high energy physics and the closely related problems of communication and collaboration between central Laboratories such as CERN and outside groups. As the Chairman of CERN's Library Committee he also took part in the elaboration of documentation policies.

Among other activities, he has remained interested in nuclear affairs as scientific adviser to ENEA (European Nuclear Energy Agency) where he played a large part in launching common enterprises (including the Dragon reactor project) and other activities of this organization. In 1964, he was awarded the ' Officier de la Légion d'Honneur ' and in 1968 he

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was one of the recipients of a citation and prize, awarded by the US Atomic Energy Commission.

Professor Kowarski has been teaching for several months each year, first at Purdue University and later at the University of Texas. He is now giving lectures at the Institut Universitaire d'Etudes Européennes.

Professor Preiswerk

Professor Preiswerk was born at Basle, Switzerland, in 1907. He went to the University there and to the University of Berlin, where he heard lectures from many of the great physicists, such as Nernst, Planck, von Laue, Schrödinger and Bothe, who were there. He returned to Basle and received his Doctorate in 1933.

The following year, he moved to the laboratory of Madame Pierre Curie, and became a collaborator of Frédéric and Irène Joliot, who had just discovered artificial radioactivity. He worked later with H.V. Halban on slow neutron physics. Among the papers they published was one which reported that neutrons reach thermal equilibrium in hydrogenous substances, and another that neutron resonance absorption is dependent on the velocity of the neutrons. This research later became significant in the field of the application of nuclear power.

At the end of 1936, Professor Preiswerk returned to Switzerland, to the Eidgenössische Technische Hochschule (ETH) in Zurich, to build one of the first cyclotrons to be constructed in Europe, and later he published a great number of papers on nuclear spectroscopy. He lectured at the ETH on Experimental Physics from 1946, and became Professor in 1950.

In December 1950, he was present at the meeting of the Commission of Scientific Cooperation of the European Cultural Centre, when the creation of a European high energy physics Laboratory was discussed. At this meeting, he suggested two possible sites for the Laboratory — one near Geneva (in the French Free Zone), and one in Alsace near Basle, giving preference to the first. Professor Preiswerk then played an important role in bringing this Laboratory into reality. He was one of the handful of experts, who were called together by Professor Auger in 1951, to coordinate the thinking of scientists in the interested European countries and to fix the aims and nature of the organization.

With the setting up of the interim organization of CERN he became Deputy Leader of the Laboratory Group with a Planning Office in Zurich, and a member of the Executive Group. From 1954, he was Director of the Site and Buildings Division, responsible for the planning and installation of the site and the construction of the buildings to house the synchro-cyclotron, the proton-synchrotron and the laboratories. When the first construction period was over he moved to the Synchro-cyclotron Division in 1958 and in 1961 became Leader of the Nuclear Physics Division until 1971.

Professor Preiswerk is a member of the European Physical Society where he is Chairman of the High Energy and Particle Physics Division and on the Conference Committee.

To both these scientists, who have given a large part of their lives, energies and talents to their work for CERN, we wish many years of full and satisfying activity in their well earned retirement.

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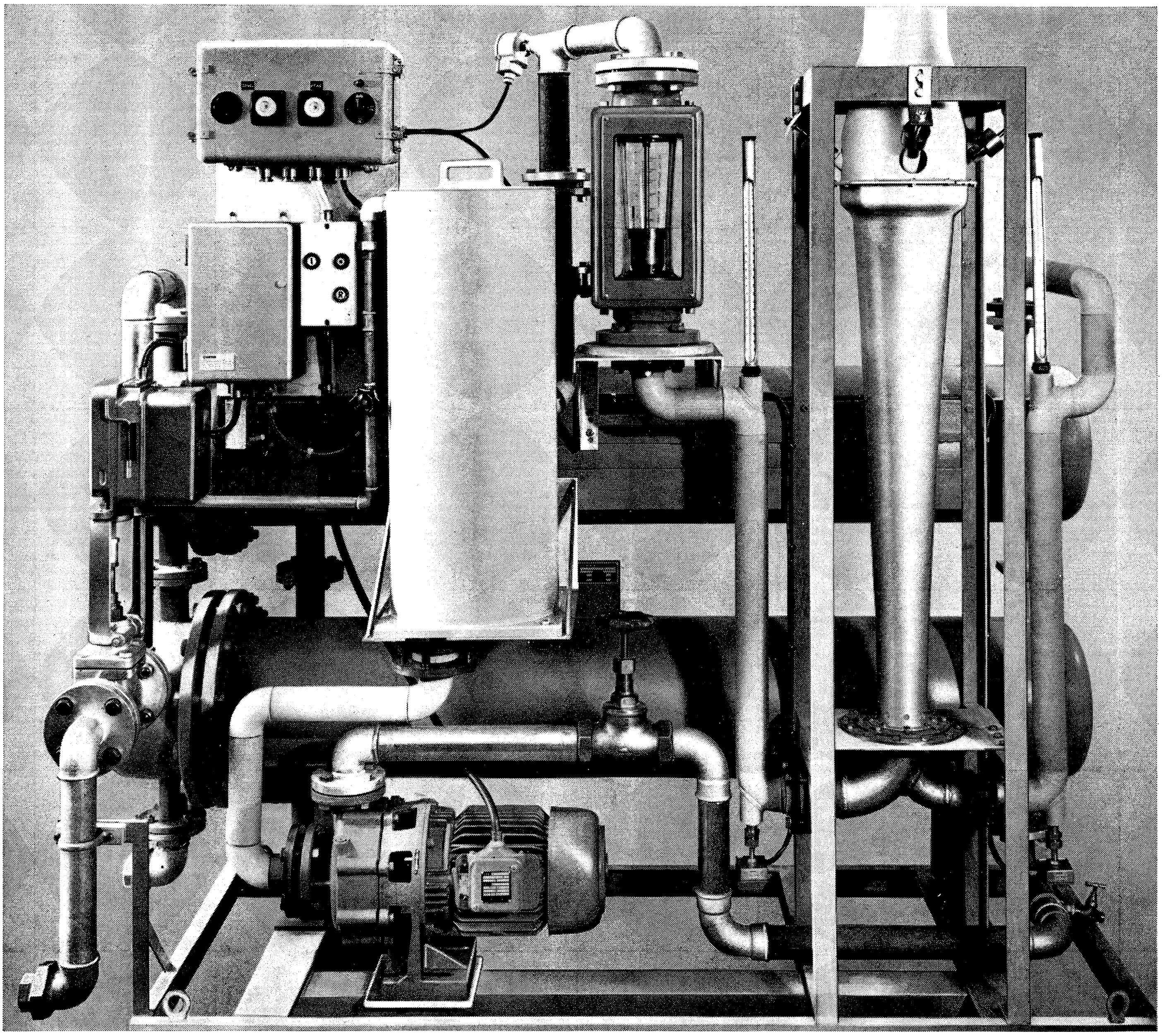

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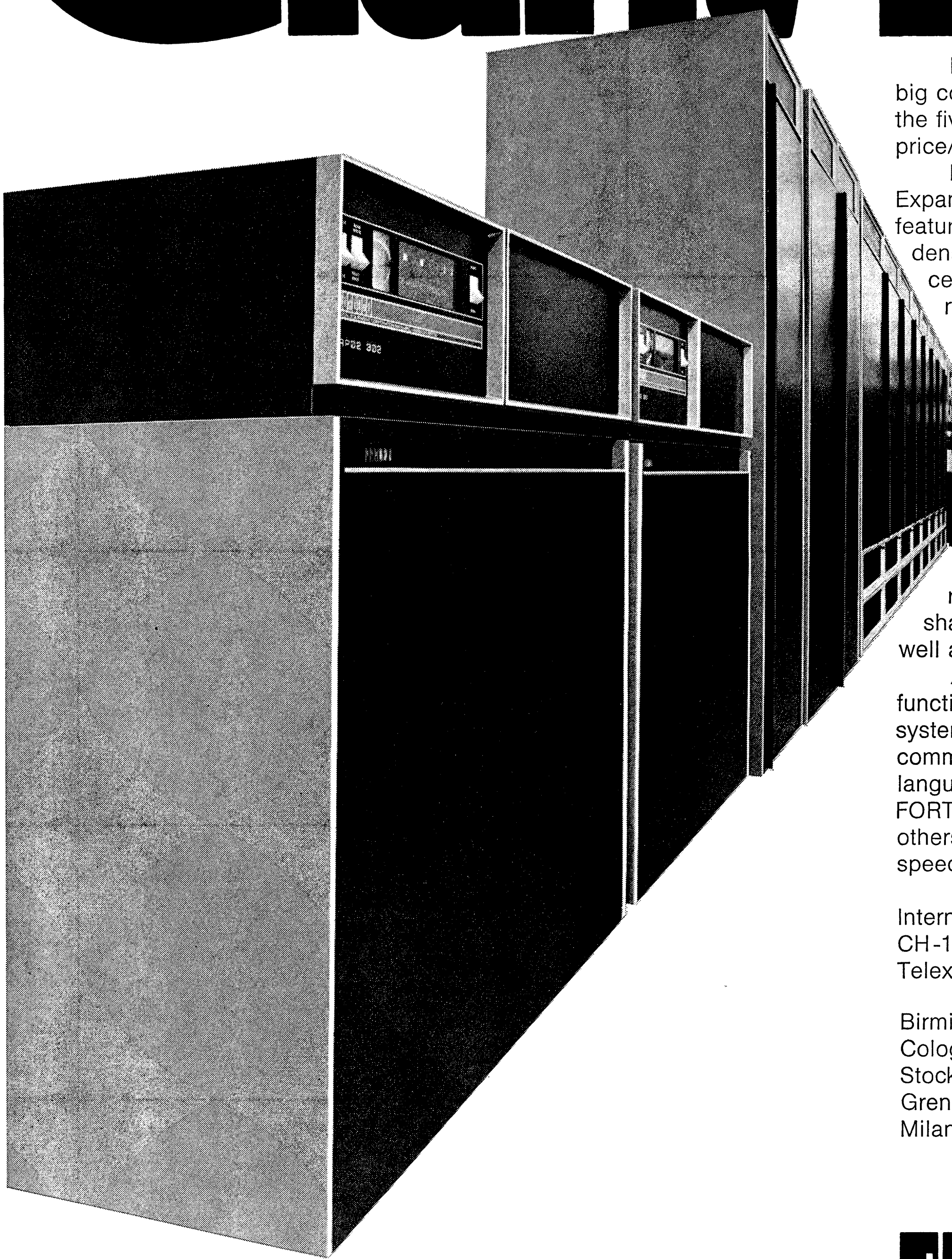

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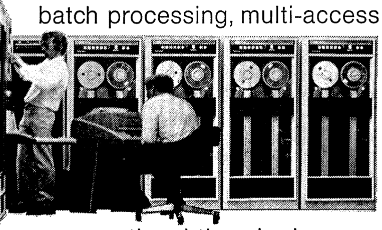

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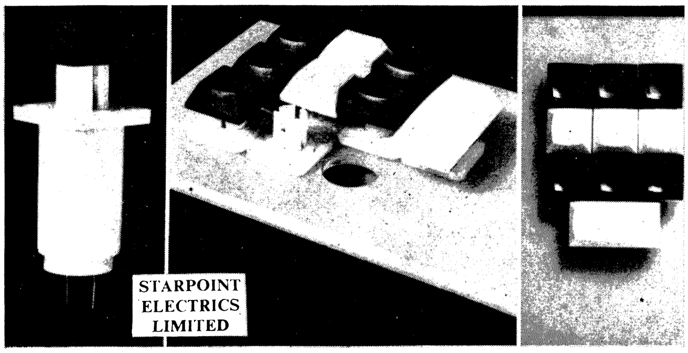

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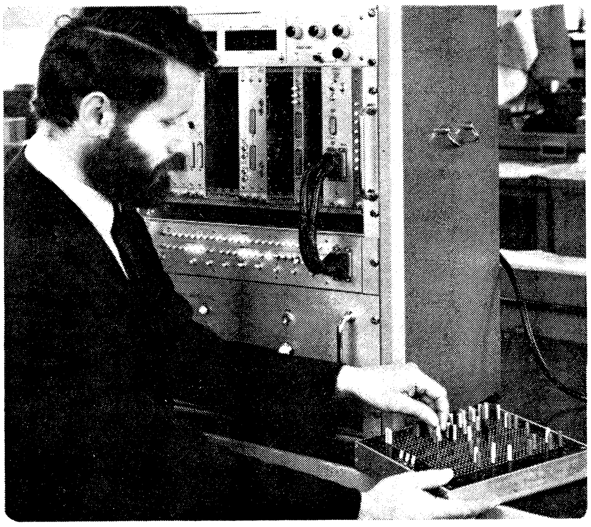
Connectors, biaxial and triaxal
Connectors, high voltage (2 - 5 - 8 - 10 - 15 - 30 KV.DC)
Connectors, multi-coaxial, multiple contacts, multiple high voltage

Connectors, combined, high and low voltage
Connectors, combined, coaxial and signal
Connectors, combined special
Connectors, for thermo-couples
Adaptors to connectors type: BNC - UHF - C - N - CONHEX - PET - Suhner - G. Radio, etc.

LEMO S.A.

Electrotechnique - Tel. (021) 711341 - Telex 24683 - 1110 Morges - (Switzerland)



CAMAC

we supply the hardware design the systems write the software...

CURRENT UNIT LIST

Parallel Input/Output

7014-1 Parallel Input Register
7016-1 Driver
7017-1 Parallel Input Gate
7018-1 Parallel Input Gate
7054-3 Parallel Output Register
7059-1 Parallel Input Gate
7060-1 Parallel Input Gate
9002 Driver
9013 Driver (and Parallel Input Gate)
9017 Driver (and Parallel Input Gate)
021 Pattern Unit
022 Parameter Unit

Serial Input/Output

7039-1 Preset Counting Register
7040-1 Dual Counting Register (BCD)
7070-1 Counting Register
003-4 Microscaler (Quad Scaler)
002 Miniscaler (Dual Scaler)
9015 Quad 75MHz Scaler
9021 Quad B.C.D. Scaler

Specific Device Input/Output

7043-1 Teletypewriter Driver
7045-1 Delayed Pulse Generator
7057-1 B.S. Interface Reader
7058-1 B.S. Interface Driver
7061-1 Teletypewriter Input/Output
7064-1 Peripheral Reader (Paper tape reader etc.)
7065-1 Peripheral Driver (Paper tape punch etc.)
7068-1 Binary to BCD Converter

Digital Signal Processing

7019-1 Clock Pulse Generator
7020-1 Dual Gate
7021-1 Fan-Out
7051-1 IL2 to IL1 Converter
7052-1 IL1 to IL2 Converter
7053-1 L1 to IL1 Converter

Analogue Input/Output

7011-2 Display Driver
7015-1 Digital to Analogue Converter
7055-1 Analogue to Digital Converter
*9028 Storage Display Mode Generator
9027 Low level Amplifier

Analogue Signal Processing

7066-1 Switch
9004 Dual Attenuator
9026 Solid State Multiplexer
9024 Low Level Relay Multiplexer

Control Equipment

System Controllers
7022-1 Dataway Controller DDP 516
7025-2 Programmed Dataway Controller
7047-1 Auxiliary Controller
7048-2 Dataway Controller PDP-8
7049-1 Auxiliary Controller PDP8
Other Control Equipment
7013-1 Interrupt Request Register
7037-1 Sequential Command Generator
7044-1 Program Module
7062-1 Command Generator
7063-1 Transfer Register
7077-1 Plugboard Store
0361-1 Program Plugboard
0362-2 Program Control Unit
*EC218 Interrupt Request Register

Chassis

7005-2 Crate
7009-2 NIM Adaptor
9001 Power Supply
9005-1/2 Module Kit
9022 Power Unit
9023 Powered Crate

Test Equipment

7007-1 Extender
7024-1 Manual Dataway Controller
7074-1 Power Indicator
0704-1 Power Indicator
0705-1 Digital Display
9014 Indicator
*9018 Dataway Buffer
*9019 Dataway Display
9020 Word Generator
*9006 Decimal Display Controller
*9007 Decimal Display

**Developed in collaboration with Daresbury Nuclear Physics Laboratories.*
7000 Series developed in collaboration with A.E.R.E. Harwell.

For latest details of the extensive range of MODULES IN PRODUCTION NOW and our SYSTEMS CAPABILITY contact

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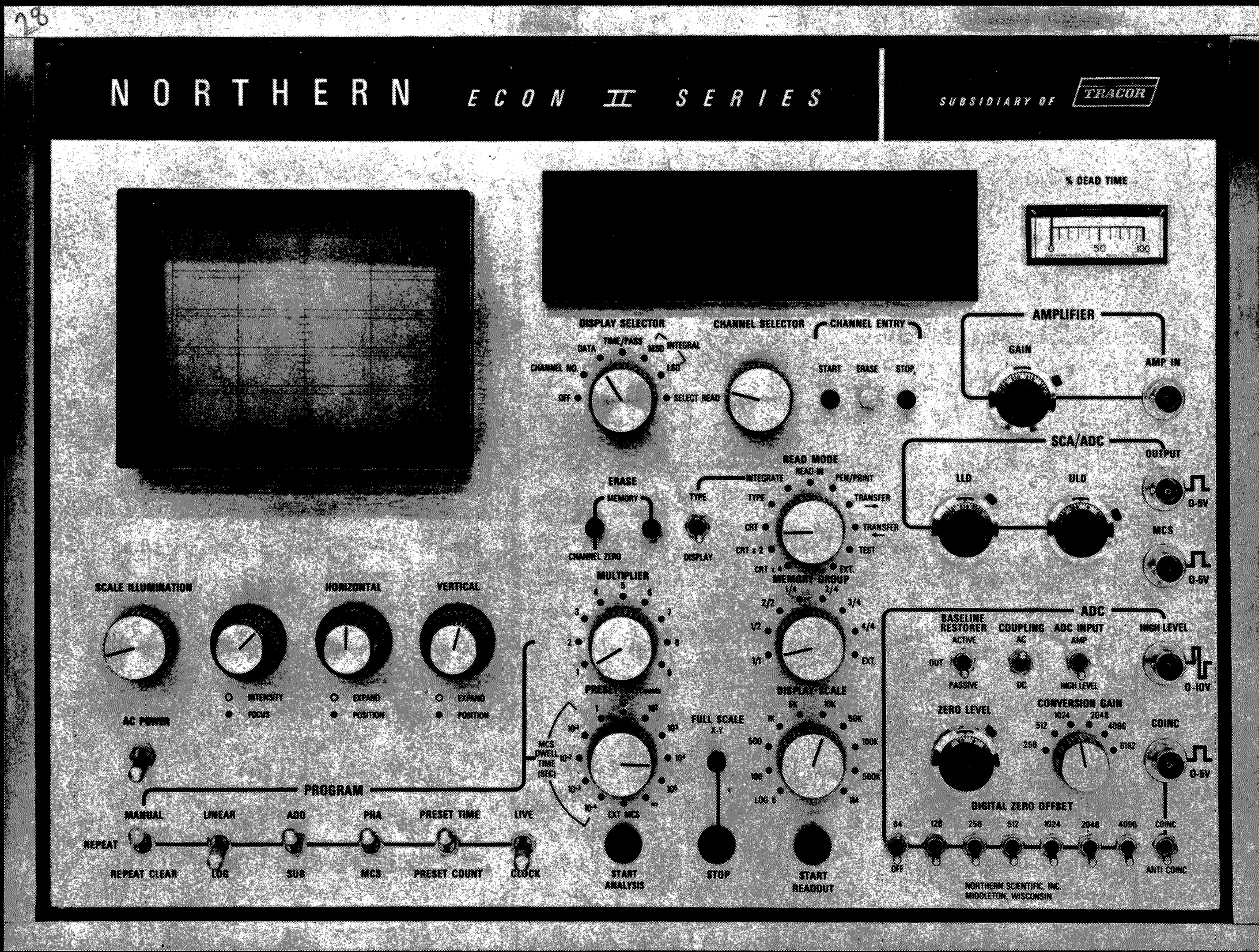
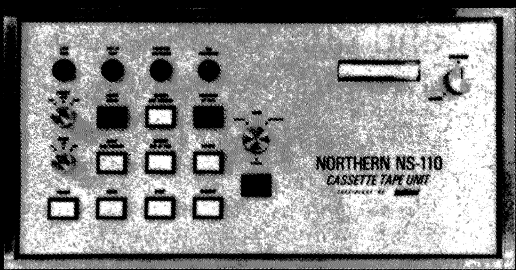
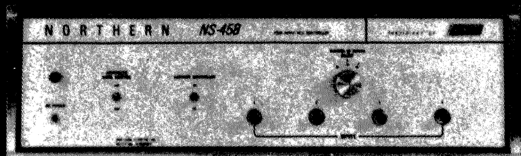
Cables: Devisotope, Woolhampton
Associate Companies:
Nuclear Enterprises GmbH, 8 Munich 2, Karlstrasse 45, West Germany. Tel. 55 30 03. Telex: 529938
Nuclear Enterprises Inc., 935 Terminal Way, San Carlos, California 94070. Tel. 415-593-1455. Telex: 348371

PERIPHERALS? Anything goes with the NS-700 PULSE HEIGHT ANALYZER

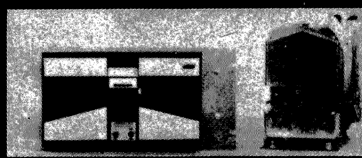


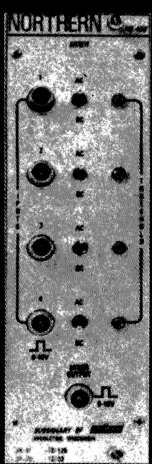


NS-110 Cassette Tape Unit

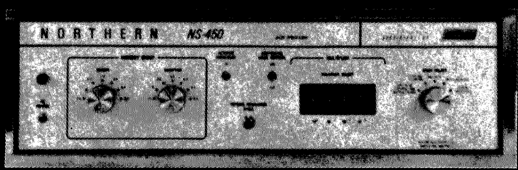


NS-458 Four Input Multiscaler

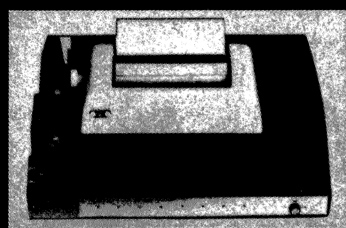

High Speed Paper Tape Punch and Reader



NS-459 Mixer/Router



NS-450 Data Processor (Spectrum Stripper)


Model 33-ASR Teletype

Wang Magnetic Tape System with NS-406M Magnetic Tape Controller

In addition to the peripherals shown here, many others — including X-Y Recorders, Parallel Printers and Computer Interfaces to Nova, PDP-8 and PDP 11/15 Systems — are available with the NS-700.

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