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 scientifice 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. CERN is one of the world's leading Laboratories in this field.

The experimental programme is based on the use of two proton accelerators — a 600 MeV synchro-cyclotron (SC) and a 28 GeV synchrotron (PS). At the latter machine, large intersecting storage rings (ISR), for experiments with colliding proton beams, are under construction. Scientists from many European Universities, as well as from CERN itself, take part in the experiments and it is estimated that some 700 physicists outside CERN are provided with their research material in this way.

The Laboratory is situated at Meyrin near Geneva in Switzerland. The site covers approximately 80 hectares equally divided on either side of the frontier between France and Switzerland. The staff totals about 2350 people and, in addition, there are over 400 Fellows and Visiting Scientists.

Thirteen European countries participate in the work of CERN, contributing to the cost of the basic programme, 197.5 million Swiss francs in 1968, in proportion to their net national income. Supplementary programmes cover the construction of the ISR and studies for a proposed 300 GeV proton synchrotron.

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Comment

The selection of the site for the proposed 300 GeV Laboratory is one of the most difficult decisions ever to face the CERN Council. An enormous amount of effort, both by experts in the nine Member States who are offering sites and by representatives of the Organization, has gone into compiling information, technical and social, on which to base the final decision.

The latest stage of this work has been the report of the Site Evaluation Panel consisting of three Council delegates (J.H. Bannier, J.K. Boggild, A. Chavanne) from States not offering sites. They have looked at all the information, have attempted to evaluate the merits of the various sites, and have presented their conclusions for discussion by the Council. (They have also done a valuable job in evolving a voting procedure for the site selection which was accepted at the March Council meeting).

An evaluation such as this done by the Panel cannot help but be subjective in some of its elements and practically all the States offering sites have some comment on points where they disagree with the Panel's findings. Each of the interested States are pushing and will continue to push hard for their own site. Differences of opinion are inevitable. Pressures and disappointments are an unavoidable part of the process. Only one site can be selected and eight States will be the losers.

But in all the moves so far towards the decision, the openness and the unanimous desire that CERN should eventually emerge with the best site for the 300 GeV accelerator has been remarkable. In the site selection procedure, for example, the Site Evaluation Panel, intending to reduce any possible embarrassment to the States, suggested that the votes should be held in secret. But speaker after speaker at the Council Meeting called for an open vote because this is the atmosphere in which the CERN Council works and in which the decision should be taken. It was agreed that the votes will be open.

The spirit in which this potentially very acrimonious problem is being approached is perhaps as fine an example as could be given of what successful international co-operation, which has always been a hallmark of the European Organization for Nuclear Research, really means.

Contents

Cover photograph : The nine sites offered by Member States of CERN for the 300 GeV Laboratory picked out on a map of Europe with samples of their rock formation. (CERN/PI 184.1.68)

37th Session of CERN Council

The Council met on 14 March under the Chairmanship of Dr. G. Funke.

The purpose of this Council Meeting was to continue the preparations for the European project for the construction of a 300 GeV proton synchrotron. Because of the urgency of the project, two extra Council Sessions (another one will be held in September) are being held this year in addition to the usual Sessions in June and December.

Definition, Management and Control of the 300 GeV Project

Last December, the Council approved a series of amendments to the CERN Convention which would make it possible to establish a second Laboratory under the auspices of CERN. One of the requirements of these amendments is that there shall be a 'definition' of each 'programme' (such as the 300 GeV project) covering 'administrative, financial and other provisions necessary for its proper management'. This definition is an essential document since the whole project has to operate within its terms.

The Council considered a draft definition for the 300 GeV Laboratory with a view to gathering the first reactions of the Member States to its contents. It is hoped to present a further draft at the June Meeting, taking into account the views expressed; a near-final version could then be ready for September and the final version could be presented to be adopted in December.

Several important questions remain to be resolved — such as the minimum period of participation for any State joining the project and the maximum expenditure which may be incurred during this period — and a fuller description of its provisions will be given when it approaches a more final form.

The management of the project is intended to be close to that prevailing at the existing Laboratory. The same Scientific Policy Committee and Finance Committee would serve both Laboratories, probably meeting more frequently or for longer sessions to cope with the increased volume of work. The ideal terms of reference and membership of an additional body called the 'Laboratory Advisory Committee' remain under discussion.

Steering Committee

Professor G. Puppi, Chairman of the Scientific Policy Committee announced the formation of a temporary Committee proposed by the European Committee for Future Accelerators (ECFA) and the Director General, which will have two tasks. The first is to help the Director General to deal quickly with any further questions concerning the 300 GeV project such as arose recently in the Federal Republic of Germany (see below). The second is to continue with the preparatory studies for the project both at CERN and at other centres in Europe. Other European accelerator Laboratories are keen to contribute to the 300 GeV design by tackling some of the technical problems. The new Committee will ensure that this is done in a co-ordinated way.

It has been called the Steering Committee and will be under the Chairmanship of Professor E. Amaldi. Members from outside CERN are Dr. J.B. Adams, Professor F. Amman, Dr. P. Levy-Mandel, Professor A.W. Merrison and Professor W. Paul. Members from inside CERN are Dr. M.G.N. Hine and Mr. C. Zilverschoon, with the Director General as ex-officio member.

Site Selection Procedure

The Site Evaluation Panel, whose report to the Council is discussed below, proposed in December of last year a procedure for arriving at the final decision for the site for the 300 GeV Laboratory. They attempted to find as fair a method of voting as possible. This has led to a rather complicated procedure but one which, with a few amendments, the Council was able to accept. In particular, the Council decided that the votes should not be held by secret ballot, but should all be open.

The selection would go in two stages. The first would take place when letters of intent to join the project have been received from countries representing a substantial percentage of the total contributions. It will reduce the existing list of nine offered sites to a short list of four.

All Member States will vote, listing the nine sites in the order of their preference; voting openly so that each delegate knows how his neighbour has voted. The President of Council, the Director General and the Director of Administration will act as tellers. The sites on each list receive points (9,8,7, etc.) according to how they have been placed, and from this will come two sites having the highest number of points to go on the short list. The two sites with the lowest number of points will be eliminated and the remaining sites will be voted again to obtain another two for the short list. (Provision has been made for dealing with situations where sites tie for position, etc.)

For the final choice, each Member State will announce its preference from the sites on the short list. If one site has a two-thirds majority it will be chosen, otherwise the site with the lowest number of votes is eliminated and the vote repeated. If a second vote is not successful, a further site is eliminated and the vote repeated. If this is not successful, the selection will be adjourned for at least a month and taken up at the next Council Session until the necessary two-thirds majority is secured.

Report of the Site Evaluation Panel

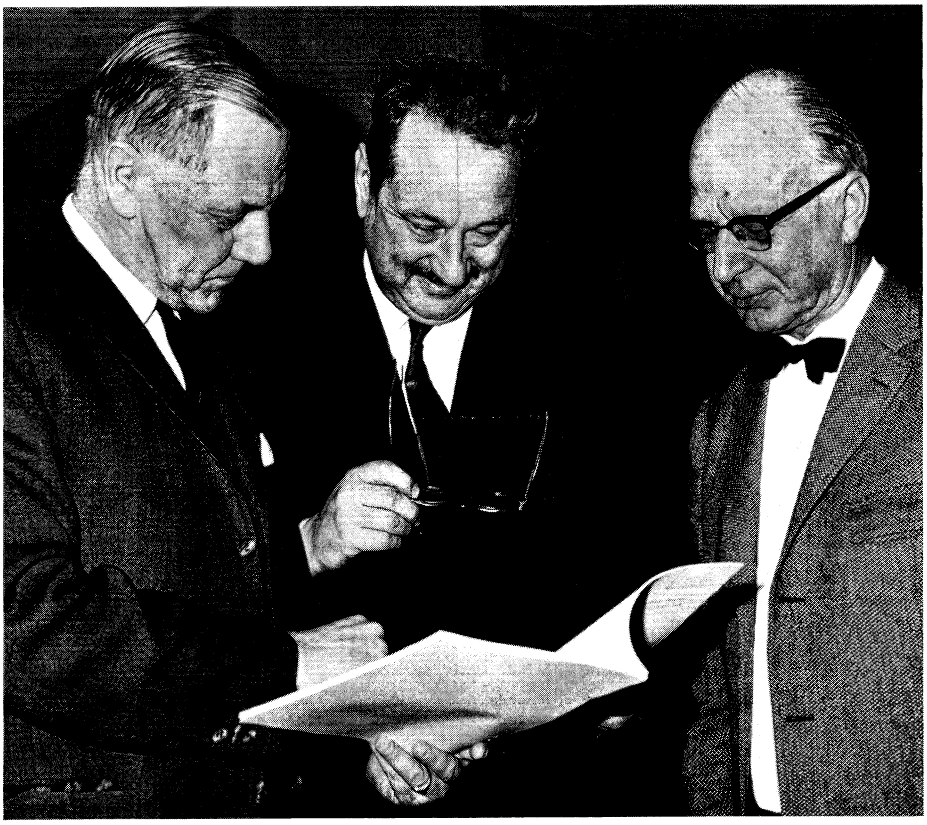
The report of the Site Evaluation Panel — Mr. J.H. Bannier (Netherlands), Professor J.K. Boggild (Denmark) and Mr. A. Chavanne (Switzerland), three Council Delegates from countries not offering sites — was made public at the Council Session, together with the comments on the report by Member States.

The Panel had the extremely difficult task of confronting the great volume of information about the nine offered sites, which has been gathered by CERN, by the consultant geologist Dr. L. Bjerrum (Norway) and by the experts in the Member States, and of trying to evaluate this information in such a way as to help the CERN Council towards the final selection of a site. Their evaluation is not intended in any way as a proposal to Council but as some guidelines particularly for establishing a short list of sites.

They examined each site dividing relevant factors into three categories —

A. Those relating to the construction and development of the Laboratory (the size and shape of the site, possibility for extension, flatness, etc..)

The three Council delegates who served as the Site Evaluation Panel — left to right J.H. Bannier, A. Chavanne, J.K. Boggild — and below a presentation of the results of their work.



CERN/PI 90.3.68

Proposed site	*Category*		
	A	B	C
Gôpfritz (Austria)	Y	Y	Y
Focant (Belgium)	Y	P	Y
Drensteinfurt (Federal Republic of Germany)	P	a	Y
Le Luc (France)	a	a	P
Aspropyrgos (Greece)	Ô	Ô	Y
Doberdô (Italy)	Y	a	a
El Escorial (Spain)	P	Y	Y
Uppsala (Sweden)	a	P	Y
Mundford (UK)	Y	P	Y

B. Those relating to the technical operation of the Laboratory (availability and quality of cooling water, availability and price of electricity, accessibility, etc..)

C. Those affecting the willingness of people to come to work in the Laboratory and the way in which families can live there (housing, education, social aspects of climate, etc..)

Each site was accorded a grading for each category according to its merit in the opinion of the Panel after examining its properties for all the factors within each category. The overall result of this evaluation is shown in the table.

Mr. Bannier pointed out in the course of his comments on the Report that this evaluation needs to be interpreted very carefully. It is a guideline and not a proposal. It cannot be assumed that the three categories are of equal importance. Later information could have modified one or two of the ratings.

Seven of the nine States offering sites — Austria, Belgium, Federal Republic of Germany, Greece, Italy, Spain and the UK — have recorded their comments on the Report of the Site Evaluation Panel. These comments were not however discussed at the Council itself but have been circulated to all delegations so that each has complete information in preparation for the time when a first vote on site selection can take place.

Answers to questions from Germany

At the December Council Session, the delegation from the Federal Republic of Germany presented a resolution passed by the German Atomic Energy Advisory Committee which raised several important questions concerning the 300 GeV project.

The resolution read... *'the German Atomic Energy Advisory Committee thinks it advisable for CERN to consider the following problems :*

— *the energy of the 300 GeV accelerator will be ten times that of the Geneva 28 GeV proton synchrotron. With the importance of the project extending far into the future, it would seem appropriate to use as much new technical know-how as possible in the construction of the accelerator. Thus, investi-*

The Director General, Professor Gregory, visited several Laboratories in the USA at the beginning of March. He is photographed here (top right) during an informal Press Conference at Brookhaven Laboratory. (Photo BNL)

gâtions should be made on a theoretical and experimental basis to ascertain whether beam-handling can be done by computers so as to reduce the costs of the magnets. Such investigations are recommended because this new technique will be used in the American 200 GeV project;

— *an advanced design and close cost calculation may help to cut construction costs of the accelerator. The significant economies made in the case of the American 200 GeV project should encourage CERN to look for new ways of reducing costs and to adopt modern planning and management methods applied in industry;*

— *the possibilities of close long-term scientific co-operation and division of labour between CERN and the United States should be further explored, especially since recent American plans will probably permit completion of the 200 GeV project by 1972 and subsequent expansion to 400 GeV without much additional cost. Furthermore, the Committee would recommend a study of the experiences gained with the 70 GeV project in the Soviet Union;*

— *the different geological characteristics of the proposed sites should be considered with a view to their financial consequences.*

After discussions with ECFA and the Scientific Policy Committee, the Director General presented a full reply. This is summarized under the different headings raised in the questions —

1. 300 GeV specification and design study:

The main requirements for the new machine laid down by ECFA are that the proton synchrotron should have an energy of 300 GeV and high intensity; that it should be completed as soon after 1975 as possible, and have a large capacity for exploitation since it would be the principal facility in Europe for many years. Reliability, flexibility and economy in operation would be very important.

On the basis of this specification, CERN prepared the design study of 1964 so that decisions on the project by the Member States could be taken on a sound technical and economic basis. Further studies on this design have been kept on a very small scale as approved by the Council. The Director of the new Laboratory would produce the final design to suit the chosen site for the machine, and to absorb any technical advances which seem appropriate. It is only after selection of the Director and the site that detailed design work can sensibly proceed.

2. Technical advances and project costs:

Advances in accelerator technology were already incorporated in the 1964 design. They include — a fast-cycling booster injector, long field-free sections, novel radio-frequency accelerating cavities, prédominent use of ejected beams, avoiding alignment problems by construction in a stable tunnel, use of beam orbit correction devices with a small vacuum chamber aperture. (The answer to the question on beam control by computers is built into this last point. Beam observation and correction, involving the use of a computer, is already included in the design and has enabled a smaller vacuum chamber to be used, thus reducing magnet costs.) Further advances since 1964 which would be considered are the possibilities of multi-ring injectors, of static power supply, and of a beam 'bypass'.

With the advances in technology, has come a considerable reduction in cost per GeV in spite of the fact that the new machine is designed for much higher intensity. Since the 1964 design and cost estimates, there has been no development which promises to alter costs significantly. Cost comparisons with the American machine, which appear to indicate that the 300 GeV costs are much higher, are based on a misunderstanding as to what cost figures in the two cases really cover. Probably, a fair comparison is 1776 million Swiss francs for the European 300 GeV and 1500 million for the American 200 GeV, where the European machine has more facilities for experiments.

3. Management methods and cost control:

The new Director will set up a project group and an administration in a way which satisfies the Council, using whatever methods seem best.

The cost estimates are based on standard CERN practice of encouraging the maximum of competition in industry and of keeping close control on production. The planning of the large CERN projects already uses critical path methods such as PERT.

4. Collaboration with USA and USSR

Collaboration has been investigated for a long time. For example, at a high level meeting of the three groups in Vienna in 1964, an approach from Europe to construct a 300 GeV machine on a tripartite or bipartite basis met with no success.

Europe could not continue in high energy physics without the 300 GeV by means of collaboration with USA and USSR, because such collaboration is only possible in the long-term between partners of equal capability. In any case, the Serpukhov and Weston machines can serve only a fraction of the physicists of their own continents with a small number of foreign visitors.

(The Director General reported, in addition to this formal reply, that he had recently visited several Laboratories in the United States (see photograph) and the major topic in his conversations with senior scientists and officials concerned the basis of collaboration between Europe and USA. American teams will be very interested in using the intersecting storage rings at CERN for experiments since they will provide unique experimental possibilities. In the other direction, the Stanford Linear Accelerator Centre with its very high energy electron beams will be open to proposals for experiments from interested teams in Europe. Exchanges can be expected between the 200 GeV project at Weston and the European 300 GeV project on various fronts in a similar way to the very healthy relationship which has been established between the CERN 28 GeV and the Brookhaven 33 GeV Laboratories. But the Director General emphasized that his visit had confirmed his belief that, long-term, fruitful collaboration is only possible if each partner is equipped to the same advanced state.)

On the question of the timescale involved in the construction of the American and European machines, it was possible to make detailed comparisons during the visit to CERN of Professor Wilson, at the invitation of ECFA, on 8 and 9 February. The US project could be said to have started in January 1967 with the selection of the site at Weston and the appointment of Professor Wilson as Director. There is no technical reason why the same situation could not be reached in Europe by January 1969 which means a delay of two years behind the USA.

5. Differences in cost between sites:

Differences in the cost of the project due to the different geological characteristics of the sites has already been studied by the CERN group by national geotechnical experts and by the consultant Dr. Bjerrum. They have shown that these characteristics result in cost differences which, on the technically favourable sites, are very small.

To try to compare the cost of the project for each site, estimating all the varying factors for 15 years ahead, would take several years of further work. From the point of view of their geological characteristics it can be said that, in general, the technically best site will be the cheapest since construction will be simplest and the risks smallest.

Professor Flowers, for the UK delegation, who had urged at the December Council meeting that serious consideration should be given to the questions from Germany said that he found the Director General's reply entirely satisfactory and considered that it should satisfy anyone who questions the merits of the 300 GeV project.

The Next Steps

The President of the Council, Dr. G. Funke, proposed a new programme for the decisions on the 300 GeV project which calls for the major decisions to approve the project, to select the site, and to appoint the Director General in December of this year.

The hope is that at the June Session a substantial expression of support for the project will have come from the Member States, other countries adding themselves to Austria, Belgium and France who have presented their 'letters of intent'. A short list of sites could then be prepared. Also drafting of the definition of the programme should be considerably advanced.

The Scientific Policy Committee

(i) confirms that the 300 GeV accelerator will be the essential instrument in European high-energy physics for the coming decades. Only with an instrument of this size will our continent be able to retain an advanced level in this fundamental field of science and to continue and expand further its present collaboration with the United States and the Soviet Union,

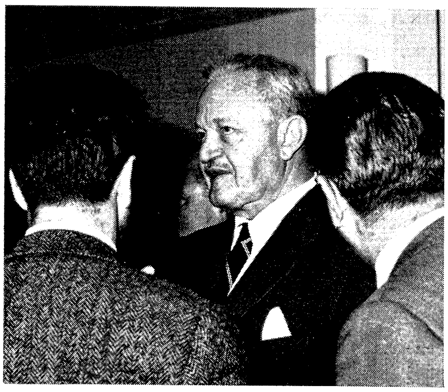
(ii) re-states its conviction that the present CERN design study and cost estimates provide Member States with an entirely adequate basis for deciding on the project, selecting the site and appointing the Director and his senior staff who will be responsible for the final design and construction of the accelerator,

(Hi) considers of the utmost importance that these decisions be taken with the greatest urgency, and therefore calls for all further letters of intent to be sent without any delay.

The September Session would then be devoted to the final preparation for the December decisions, including staffing questions for the new Laboratory, the management of Council business and the final touches to the programme definition.

The wish of the President to push the work forward as quickly as possible received strong support during the Council Session from a resolution passed by the Scientific Policy Committee, presented by Professor G. Puppi.

Professor Puppi also mentioned that the SPC had already discussed the appointment of the Director General and



CERN/PI 91.3.68

CERN/PI 92.3.68

People in the news : 1. Ambassador Giusti del Giardino, retiring Council delegate. 2. Dr. W. Schulte-Meermann, retiring Council delegate.

would be ready to make a recommendation if called upon to do so by the Council.

Professor Perrin expressed the profound concern of the French government at the further delays in the project. He was afraid that it indicated a lack of confidence in Europe's ability to maintain a pre-eminent position in this field of research which was perhaps the only major one in which we were on a par with the USA. The Director General said that we have to restrain our impatience and work to ensure that we are poised ready to start as soon as a decision is forthcoming.

Budgets

Professor B.H. Flowers for the UK delegation called for efforts to reduce the budget figures proposed by the CERN administration for 1969 and 1970 to ease the present difficulties of the UK. He also said that the rate of growth in CERN expenditure is too steep and that perhaps the time has come to assign priorities to the activities, all of them ideally desirable, that CERN would like to undertake.

The Director General said that the problem is related to the fact that the budget is dictated by the demand. This has even exceeded that predicted by ECFA and the requests for the use of CERN facilities by visiting scientists from the European Universities is still growing. To reduce the budgets would mean that the demand could not be met and all the participating countries would need to be a party to such a decision.

New appointments

Mr. J.H. Bannier was appointed Vice-President of the Council to replace Ambassador Giusti del Giardino who is leaving Geneva to represent his country, Italy, in Tokyo.

The President also said good-bye on behalf of the Council to another of its prominent members — Dr. W. Schulte-Meermann (Federal Republic of Germany).

Dr. E.G. Michaelis was appointed Leader of the Synchro-cyclotron Division in succession to Dr. G. Brianti.

CERN News

The CDC 3800 computer counting the votes cast in the Canton of Geneva during the elections last October.

CDC 3800 to Geneva

The Grand Conseil of Geneva accepted in February the purchase of the CDC 3800 which has been at CERN on rental since September 1966. The computer will move to a building of the University of Geneva probably towards the end of this year and will be used both by the University and also for some of the administrative work of the Geneva cantonal authorities.

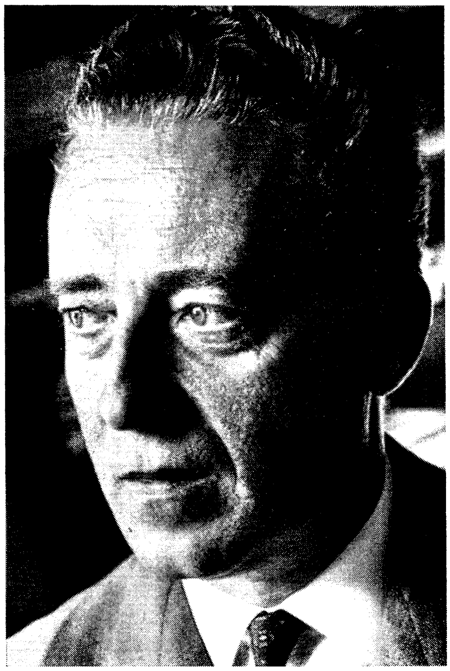
The 3800 came to CERN to replace a 3400, of which it is an improved version, as part of a temporary exercise to ease the computing problems of CERN during the teething troubles of the CDC 6600. This exercise is now over and CERN had the possibility to purchase the 3800 under very favourable terms. Geneva had already manifested its interest in acquiring a large computer to cope with its growing needs for computation and CERN was able to offer the 3800 at a sum much below the cost of the machine as new. The cost to Geneva is 4.9 million Swiss francs.

The Geneva administration envisage a 2 to 5 year period of training personnel to use computers, the programming of a large amount of administrative data, a detailed analysis of the work of various departments, the reorganization of work, etc... The computer has already had a trial run for the administration when it was used in the analysis of the results of the Cantonal elections last October. The University intends to set up a training programme to produce computer specialists. It has considered the possibility of establishing an Institute, specializing in Information Studies.

The 3800 has a central memory of 65 536 words of 48 bits. It is fed by eight magnetic tape units capable of transferring 120 000 characters per second, and by a punched-card reader which can read 1200 cards per minute. A line-printer prints out results at the speed of 100 lines per second.

The University is already making considerable use of the computer. It will remain at CERN until the building made available is ready to receive it, and CERN will help in the training of staff to operate the machine. When the computer leaves CERN, CERN will still have some limited use of it in Geneva.

CERN/PI 170.10.67



Professor O. Reverdir) (Photo Freddy Bertrand)

There have been long discussions concerning the purchase of the computer and the decision has not been an easy one for the Geneva authorities to take. CERN's decision to dispose of the machine, which was always here as a temporary measure and which does not line up with the rest of the central computer system, was sometimes misinterpreted as a rejection of an outmoded machine. A reply to this question was given to a journalist by Dr. G. R. Macleod, Head of the Data Handling Division — NASA has just bought eight computers for its centres throughout the world which track and correct the orbits of their satellites. They are all CDC 3800's.

Contracts

Some contracts for the intersecting storage rings project recently placed by CERN:

Brown, Boveri and Co., Federal Republic of Germany, was awarded the contract for the manufacture of 169 quadrupole magnets for the beam transfer system of the ISR at a cost approaching 3.5 million Swiss Francs.

The task of guiding the accelerated proton beams from the synchrotron to the ISR and to the associated experimental hall (West Hall) is a formidable one. It involves taking beams through an underground tunnel from the PS towards the ISR dividing half-way into two branches one to feed each of the storage rings. In addition, a beam goes direct to the West Hall without connecting with the ISR and one goes from the ISR to the West Hall. A total length of 1.6 km of beam-line, involving a large number of quadrupoles (to keep the beams focused) and bending-magnets (to steer them along the right path), is needed.

The quadrupoles will be placed at intervals of about 9 m along the beam-lines and, as usual, will be of two types — focusing (73 magnets) and defocusing (74 magnets). There will also be special longer quadrupoles (22 magnets) to 'match' the beam from the synchrotron to the beam-line, from the beam-line to the ISR and so on. The poles of the magnets have to be laminated, so that they can be adjusted quickly as the energy of the beams is changed. Also, the pole profiles have to be manufactured to tight tolerances to meet the need for field gradients accurate to about 1 part in 10^3 over most of the magnet aperture.

Twenty-two European firms were contacted concerning the contract and 12 tenders were received. From these the Finance Committee approved the offer of Brown, Boveri and Co.

The contract for the main power supplies of the ISR magnets has been placed with Smit, Netherlands, and Brentford, UK, for a cost of almost 1.8 million Swiss francs.

Two d.c. supplies each of 6.9 MW (1840 V, 3750 A) are needed, one for each ring of magnets. To ensure that the ISR can store protons at a variety of energies, the supplies have to be capable of operation from the peak current of 3750 A down to a quarter of this value. Within this range continuous adjustment must be possible so that the stored protons can be slowly accelerated or decelerated.

The stability requirements are severe. Since even short-term fluctuations of the magnet field strength can result in the beams being lost, the supplies have to be stable for large voltage fluctuations (+ 5 to - 8%). A long-term precision of $\pm 10^{-4}$ of the selected current is required with even tighter precision during injection. The voltage on the magnets has to be ripple-free (less than 2×10^{-4} peak to peak) to avoid affecting the stacking process when beams are being fed into the rings, and also to permit efficient slow-ejection of the protons.

A solid-state rectifier system is cheaper than motor-generator sets at the power levels involved and 21 European firms were invited to tender on this basis. Ten offers were received and the Finance Committee approved the contract with Smit-Brentford at its meeting of 31 January.

The copper cables for connecting the ISR main magnets will be supplied by Kabel und Metallwerke, Federal Republic of Germany, at a cost of just over 1.6 million Swiss francs.

The magnet coils in each of the rings will be connected in series by water-cooled single core cables. The contract covers the supply of a total cable length of 15.1 km in 672 sections. In addition, 996 connection pieces are required to join cable lengths and to connect the cables to the coils on the magnets.

To carry the peak current of 3750 A, it was calculated that 1800 mm^2 would be the most economical copper cross-sectional area. But water-cooled cable with this bulk of copper would be extremely difficult to install and it has been decided to divide the load for each connection between two cables each with 900 mm^2 of copper cross-section. The cooling water will run through the centre of the cable.

Twenty European firms were contacted and six offers were received. The Finance Committee, at its meeting on 31 January, approved that of Kabel und Metallwerke.

Professor O. Reverdin

Professor Olivier Reverdin has been elected President of the Swiss National Foundation for Scientific Research. He is already President of the Swiss Society for Social Sciences and of the Commission for Science and Culture of the Council of Europe, and now fills one of the key posts concerned with Swiss policy on higher education and research.

Professor Reverdin was born in Geneva in 1913 and studied at the University of Geneva, at the Sorbonne in Paris and at the French Athenean School. After serving in the Diplomatic Corps during the war, he moved into journalism becoming a Director of the Journal de Genève, a post which he occupied until Autumn 1967. He has also had a distinguished career in education and has been Professor of Greek Language and Literature at the University of Geneva since 1958.

Professor Reverdin has always been concerned to give Swiss policy in cultural and scientific affairs a forward looking approach. He is interested particularly in the development of high energy physics research and in molecular biology. This latter interest was particularly noticeable when Professor Reverdin was elected President of two European Molecular Biology Conferences held at CERN.

News from abroad

The Karlsruhe Project

A seminar on the Karlsruhe 40 GeV proton synchrotron project was held at Karlsruhe, Federal Republic of Germany, on 16-17 February. It was attended by sub-nuclear physicists and accelerator physicists from France, Germany and CERN. The discussion concentrated on the usefulness of a 40 GeV machine in the light of the present experimental situation, on explaining the possibilities of the proposed machine and the modifications which have been studied since the original design was announced, and on amalgamating ideas for further study on the machine and the experimental lay-out.

The chief topics in sub-nuclear physics which call for an accelerator of energy around 40 GeV are — to extend the meson spectrum to higher energy, to investigate hyperon scattering, and to do experiments on muons and on hyperon decays. Several of the possible experiments discussed at the seminar involved the use of superconducting components and Karlsruhe envisage making extensive use of superconductivity techniques (for beam-transport magnets, r.f. separators, wide-angle bending magnets...) to achieve the best possible experimental area lay-out.

The main features of the original design of the machine were presented at the Cambridge Accelerator Conference in September of last year (CERN COURIER vol. 7, page 202). The main ring is 300 m in diameter with a peak magnetic field of 13.6 kG. Injection is in two stages — a 30 MeV linac and a 2 GeV separated-function booster, consisting of three stacked rings, 100 m in diameter. With this high injection energy, the vacuum vessel cross-section in the main ring can be kept down to 4 X 8 cm^2 and the magnet (and ring building) size reduced. The cost estimate was given as 121 M DM (65 M for the machine itself and 56 M for the associated buildings).

At the Cambridge Conference, there was comment that all the 40 GeV projects were planning for too low an intensity. Karlsruhe have now worked out modifications which would make it possible to increase the intensity to 10^{13} protons per second. They have also studied the possibility of increasing the energy to 60 or 70 GeV.

The intensity increase comes comparatively easily from modifications to the injection system. The linac energy would be raised to 50 MeV and the linac current increased by a factor of ten. The booster would move from 2 to 5 GeV, using an increased vacuum vessel aperture (7 X 14 cm^2 becoming 9 X 17 cm^2), about 40% more bending magnet and higher field in the bending magnet (5.6 kG becoming 8 kG). The main ring would remain the same, except for more r.f. power, but extra precautions have to be taken to reduce the closed orbit distortions to about Vs of the values that were tolerable in the original design. (The intensity is limited by the emittance of the injector; space charge limit is 5 X 10^{13}.) In both the booster and the main ring, observation and correction of the closed-orbit position would be built in.

The additional cost of the intensity increase is estimated at 30 M DM; to make higher intensities eventually possible 10 M of this would need to be added to the cost of construction and the rest could be absorbed later when the improvement to higher intensity was called for.

In considering increased energy, the Karlsruhe team selected 60 GeV to evolve some design figures. This would require a main ring 400 m in diameter with a peak magnetic field of 18 kG. Both separated-function and combined-function magnet lattices are under consideration. The version which has been evolved retains the same intensity per second as the original design (1.25 X 10^{12} protons per second) but increases the repetition rate to two per second. Injection energy remains at 2 GeV. The increase in cost compared with the original design figures is again estimated at about 30 M DM — the same increase as for higher intensity.

At the Seminar, the participants generally seemed to favour a move to higher energy rather than higher intensity.

The 40 GeV project in Japan (CERN COURIER vol. 7, page 201) developed at the Tokyo Institute for Nuclear Studies, has not been awarded money for construction in the budget for fiscal year 1968, (which runs from April to March) as had been hoped. Construction could start now only in 1969. The accelerator would probably be sited in the proposed 'Science City' at the foot of the Mount Tsukuba about 80 km north-east of Tokyo. It has not yet been decided whether the Laboratory would be under direct government control or whether it would have the same degree of autonomy as the Universities.

Recording rads at Rutherford

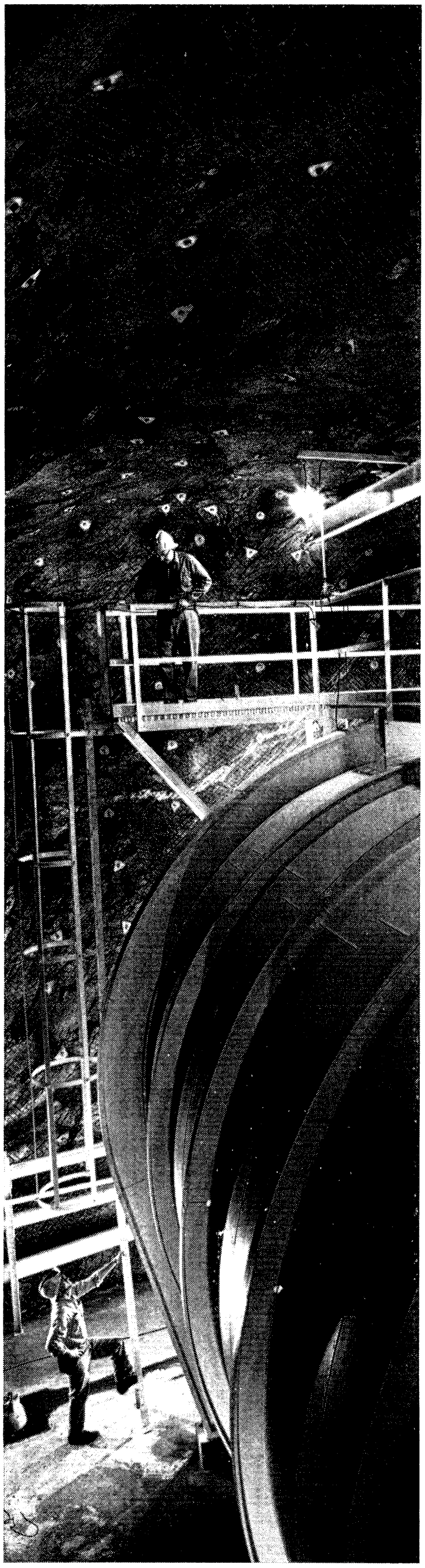
The Rutherford Laboratory displayed, at the Physical Society Exhibition in the UK from 11-14 March, a newly developed method of measuring high radiation doses. A small team, led by R. Sheldon, has produced a device called a hydrogen dosimeter, which gives precise integration of radiation dose and which can be read remotely if required.

All accelerator Laboratories need information about the radiation dose likely to be received by various components of the machine. Although materials which are more and more 'radiation resistant' have been produced, it is still important to know just what dose components are receiving in order to estimate their useful life. They can then receive attention before the effect of radiation has seriously impaired their properties, such as their mechanical strength or their electrical insulation. This is particularly important for organic polymer materials, which are sensitive to radiation, used as insulation on magnet coils, etc.

The Rutherford Laboratory has an additional concern in that the vacuum vessel of the 7 GeV proton synchrotron, Nimrod, is made of glass-fibre reinforced epoxy resin. They have therefore given considerable attention to the problem of radiation dose measurement.

Many methods have been developed in the past but none proved ideal to be adapted to rapid and regular use over a very wide range of doses. The hydrogen dosimeter, now in use at Nimrod, consists of a small glass or stainless-steel capsule containing polyethylene powder. It has been found that the pressure of hydrogen

One end of the huge tank of tetrachloroethylene catching neutrinos down a South Dakota gold mine. (Photo BNL)



gas, which builds up in the capsule as the powder releases hydrogen under the effect of radiation, is a precise integrating measure of the radiation dose received by the capsule. Measurements in the range 10^6 to 10^9 rad (the rad is the unit of absorbed dose) can be made by connecting the capsule, via a capilliary tube, to a Bourdon-type pressure gange. Remote read-out is possible; it is an obvious advantage to be able to take readings remotely, so that it is not necessary to open up the accelerator to examine the dosimeters.

Twenty-three of these units, each consisting of five 'integrating-dose' capsules, were installed on Nimrod about a year ago together with several hundred 'single-dose 'capsules'. They have proved to be robust and satisfactory in operation.

First catch your neutrino

A team of scientists from Brookhaven Laboratory, led by R. Davis, have set up a 380 000 litre tank of cleaning liquid, 1470 metres down the Homestake Gold Mine in South Dakota to catch neutrinos. Their paradoxical purpose in going deep into the earth is to find out what is going on deep in the sun. The elusive, ubiquitous neutrino is the particle that they hope will act as communicator, in what is surely one of the most imaginative experiments ever devised.

The experiment is usually referred to as the Brookhaven solar neutrino experiment. Its purpose is to test current theories of the ways in which the sun generates its energy. One of the products of nuclear physics has been an explanation of solar energy generation in terms of the fusion of the lighter chemical elements, particularly the hydrogen and helium isotopes. A series of fusion interactions can be written down to show how the energy is produced and among the products of the interactions is a high flux of neutrinos. It is estimated that the sun produces ovec 10^{37} neutrinos every second.

Most of the neutrinos are however in the low energy region. For example, the fusion of two hydrogen nuclei

$$H + H \rightarrow D + e^+ + \nu$$

yields neutrinos with a peak energy below half an MeV. These neutrinos are very difficult to observe because of their extremely low cross-sections for interaction.

But one interaction chain yields higher energy neutrinos. First, helium isotopes produce berylium

$$He^3 + He^4 \rightarrow Be^7 + \gamma$$

A small fraction of the berylium is converted to boron by proton capture

$$Be^7 + H \rightarrow B^8 + \gamma$$

and the boron decays yielding berylium (which decays to two helium nuclei)

$$B^8 \rightarrow Be^8 + e^+ + \nu$$

The neutrinos produced in this decay have energies up to 14.2 MeV and are just about susceptible to a reasonably high rate of detection. These are the particles that the Brookhaven team is chasing. A measure of their flux will be a test of the theories of solar generation processes.

The idea is to catch the neutrinos in the interaction

$$Cl^{37} + \nu \rightarrow A^{37} + e^-$$

setting up a large volume of chlorine, filtering out and counting the radio-active isotope argon 37 which is produced. The isotope has a half-life of 35 days.

380 000 litres of tetrachloroethylene in a large tank, 6.6 m in diameter, 14.8 m long, provides the large volume of chlorine. After long exposure in the underground laboratory, where only neutrinos can penetrate, helium gas is passed through to purge the liquid of argon. A charcoal trap cooled to almost — 200° C is then used to absorb the argon while allowing the helium to pass through. This processing takes about ten hours and argon extraction efficiencies of over 90 % can be achieved.

The argon is then conveyed to Brookhaven and the number of A^{37} atoms is counted in a low-level proportional counter. The count is of the Auger electron, which has a characteristic energy of almost 3 KeV, in the decay of the A^{37}.

The counter is located inside the 40 cm bore of an old navy gun-barrel which acts as a shield from cosmic radiation. The guns are of course, made of 'old' iron and contain a very small level of residual radio-activity.

(We can't resist disgressing here with a little story told by LM. Lederman during a lecture about the famous experiment at

Brookhaven which first showed that two types of neutrino exist. He was talking about the steel shielding used in the neutrino experiment... 'If you look closely, you can see that some of the steel is marked U.S.S. Missouri. This steel is available only because the battleships are obsolete, and in fact during the Cuban crisis we were afraid the Navy would take it back. The application of obsolete Naval equipment to high energy physics is interesting. In another experiment we are planning now at the AGS, we use some of the cannons from perhaps the same ship; large cannons make very good collimators. They have tremendous wall thickness and are 50 ft long. The only trouble is they have rifling, and we had to have a graduate student crawl in to smooth it out. He quit, and I do not know where we shall find another student of his calibre'.)

The various theoretical calculations on the neutrino flux to be expected from the boron decay in the sun give forecasts ranging from about 6 X 10^6 to 21 X 10^6 neutrinos per square centimeter per second. Knowing the efficiency of neutrino capture in their tank, the Brookhaven team could expect to catch from about 1.5 to 5 neutrinos per day according to which theory was correct. Their very preliminary results seem to point to the lower end of this range with a rate of less than 2 per day.

An indication of just how refined the detection technique has to be, is that at equilibrium (when A^{37} is being produced in the liquid at the same rate as it decays) only about 300 atoms of A^{37} will be present in the whole 380000 litres of tetrachloroethylene. Thus this unusual alliance of physics and chemistry is plucking each argon atom from over a million million million million others.

Cornell

The electron synchrotron at Cornell University reached its design energy of 10 GeV on 2 March with low intensity beams. (The early stages of commissionning were reported by R. Littauer at the Cambridge Conference — CERN COURIER vol. 7, page 202). Experiments started in November 1967 at an energy of 7 GeV with about 60 hours experimental time per week. The utilization has now grown to 100 hours per week. Commissioning of the machine continues and indicates that its performance will easily exceed the design figures.

Design and construction of the Cornell accelerator has been led by Professor R.R. Wilson, now Director of the National Accelerator Laboratory which will house the American 200 GeV machine.

The Director of the Laboratory of Nuclear Studies at Cornell is now B.D. McDaniel.

The Cornell synchrotron was funded in April 1965. It was initially conceived for an energy of 10 GeV but the equipment now being installed will in fact be capable of 15 GeV. The magnets could probably be powered to field levels equivalent to over 20 GeV but more r.f. power would be needed to reach these energies.

The beam intensity is still being kept low — about 10^{10} electrons/pulse at60pulses/s. The reasons for this limitation are:

i) because the experimental programme does not yet call for higher intensities
ii) to avoid excessive radiation damage during commissioning (since the linac beam chopper has not yet been commissioned a high proportion of the injected beam would be lost in the accelerator ring)
iii) because the linac has not yet been commissioned to inject for more than a fraction of a turn.

However, the capture efficiency is high and the Cornell team are confident of meeting or exceeding the design intensity of 10^{11} electrons/pulse.

Commissioning of the machine has gone very quickly and smoothly despite the fact that construction work has been continuing throughout this time. Although the ring building, the power and cooling supplies, and the control rooms were not finished at the time of first operation a very flexible control philosophy made it possible to do useful work. Most of the time, the machine can be operated from a single standard relay rack.

Two important facts are that there have been no magnet failures and no problems with the vacuum system. The design of the magnets and the absence of a vacuum vessel in the magnet aperture (the magnets are the 'picture-frame' type) are unusual aspects of the machine.

The physics programme has started well. The first experiments include rho production in the forward direction, muon pairs, backward pions, kaons, wide-angle pairs, and wide-angle bremsstrahlung. The external electron beam is under construction. Work so far has been with X — ray beams from an internal target. Preliminary results on the experiment on rho production have already been reported. Three outside University groups are participating in the experimental programme.

Dedication of the new synchrotron is planned for October 1968. It will be named the 'Wilson Synchrotron Laboratory'.

Brookhaven

The newly installed slow ejection system on the 33 GeV alternating gradient synchrotron (AGS) at Brookhaven National Laboratory produced its first ejected beams on 6 March. We hope to carry a fuller story on this next month.

CERN brought a slow ejection system into operation in 1963 (see CERN COURIER vol. 3, page 110) but its average ejection efficiency is low (50-60 %). Addition of a special septum magnet in an experimental set-up last year showed that it is possible to increase this to around 80%. At the AGS, efficiencies of about 90 % are hoped for and their work has been given added significance by the fact that a crucial aspect of the American 200 GeV design is their belief that slow ejection efficiencies can be pushed as high as 99 % when building the ejection system into a new machine.

Since we mention above that CERN beat Brookhaven to slow ejection, perhaps we can redress the balance and at the same time correct an omission in the February issue of CERN COURIER by going back to full-aperture kickers. In telling the story of the recent successful work on the full-aperture kicker at CERN, we described it as 'the first of its kind'. Strictly speaking this is correct, since the Brookhaven full-aperture kickers are of the 'picture-frame' magnet type, but we should have recalled in our article that Brookhaven have used full-aperture kickers in their fast ejection system for years.

The Convention

A revised version of the Convention of the European Organization for Nuclear Research was approved by the Council at its meeting in December 1967 and the amendments have been passed to the Governments of the Member States for their acceptance. This article is a description and explanation of the contents of this fundamental document.

The Council,

desiring to prepare for the possibility of construction of a new Laboratory to include a proton synchrotron for energies of about 300 GeV;

considering that the construction of such a Laboratory could not be carried out under the present terms of the Convention;

desiring nevertheless to retain the unity of the Organization and the spirit of the present Convention, the efficacy of which has been amply demonstrated since the creation of the Organization;

recognizing that by virtue of the terms of paragraph 1 of Article X of the Convention they are empowered to recommend to Member States amendments to the Convention;

Resolves

(a) to approve the amendments to the Convention which are attached to this Resolution;

(b) to recommend to Member States acceptance of these amendments;

(c) that the Director General should notify Member States of each such acceptance as it is received.

In passing this resolution at the December 1967 meeting, the CERN Council completed its work to make it possible to set up a new Laboratory for sub-nuclear physics, in addition to CERN-Meyrin, under the same Organization. The Council itself, its representatives, legal experts and the CERN administration had given many, many hours of attention to the revision of the Convention. Why is it so important?

The Convention is the most fundamental document governing the operation of CERN. It provides the necessary legal framework within which all the major decisions must be taken. If the framework were too restrictive there would be no scope to adjust rapidly to the unpredictable evolution of sub-nuclear physics. If the framework were too loose, the participating countries could lose control of the progress of the Organization. The Convention needs, therefore, to be carefully worded so that CERN can be steered along that narrow path which gives flexibility while safeguarding the rights and specifying the obligations of the Member States.

The existing Convention was signed at the UNESCO headquarters in Paris in 1953 and has been in force without change (except for an amendment to the'Financial Protocole') for fourteen years. Considering the great developments which have taken place in the activities of CERN in this time, it is obvious that the Convention has worked extremely well. Another indication of its success is that it has been used as a model in drawing up the Conventions of several other international organizations. However, in the light of the proposal to set up a new Laboratory to house a much more powerful accelerator, it became necessary to undertake a major revision.

It was considered important to preserve a unified policy for European collaboration in sub-nuclear physics — in other words, not to set up a separate organization for a new Laboratory. In this way, several Laboratories would be controlled by the same Council, the same Scientific Policy Committee and the same Finance Committee. The existing Convention, however, does not allow for the establishment of any Laboratory other than that of CERN-Meyrin and it had, therefore, to be revised. But since it had worked so well, the amendments were carefully phrased to preserve the spirit and whenever possible the words of the existing version.

We will now go through the revised Convention Article by Article selecting sections for explanation and comment. It should, of course, be realized that, in doing this, we sacrifice the precision and legal niceties of the document itself. The following paragraphs are not the gospel but an interpretation of it.

CONVENTION
for the establishment of a European
Organization for Nuclear Research

The Convention opens with a preamble recalling the history of the beginnings of CERN. Like several other historical clauses in the Convention, this section has been left intact in the amended version. It refers for example to the Conseil Européen pour la Recherche Nucléaire, which did most of the preliminary study on what a European Laboratory might be, and from which the initials'CERN'were drawn. After the historical paragraphs come the words 'The States parties to this Convention... have agreed as follows;'

Article I

Article I establishes the European Organization for Nuclear Research with its seat at Geneva. The revised version makes It possible to move the seat to another Laboratory by a two-thirds majority decision of the Member States. It is worth noting that the seat must be at a Laboratory so that a disembodied 'Headquarters' remote from the research centres cannot be set up.

Article II

Article II lays down the purposes of the Organization to '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.'

It is in the paragraphs which say how these purposes shall be achieved, that the major amendments appear. The amendments open the door for the 'construction and operation of one or more international laboratories', each with at least one accelerator and associated equipment and buildings. The Organization is to concern itself also with organizing and sponsoring research, which involves such things as theoretical work, promotion of contacts between scientists and interchange of scientists, dissemination of information, and advising other research centres.

The programmes of activities are defined in the revised Convention:

a) The programme carried out at CERN-Meyrin including the 28 GeV proton synchrotron and the 600 MeV synchro-cyclotron. (This is the present 'basic programme' of the Organization in which all Member States must participate.)

b) The construction and operation of the intersecting storage rings fed by the 28 GeV machine. (This is at present a 'supplementary programme' supported by all the Member States with the exception of Greece.)

c) The construction and operation of a proton synchrotron 'for energies of about 300 GeV. (This requires a two-thirds majority decision of the Member States before it can come into being.)

d) Any other programme which meets the purposes of the Organization. (This would also require a two-thirds majority decision and it is included so that other ventures could be undertaken by the Organization without the tortuous procedure of revising the Convention yet again.)

The approval of (c) or (d) involves the definition of 'those administrative, financial and other previsions necessary for the proper management of the programme'and this definition could not be changed except by a further two-thirds majority decision.

At such time as the 300 GeV accelerator came into operation it would join (a) above as part of the basic programme, and as Member States are only required to take part in one of the component programmes (a) — CERN-Meyrin, or (c) — the 300 GeV Laboratory, any State could at that point withdraw from supporting CERN-Meyrin and concern itself solely with the 300 GeV Laboratory. Also, CERN-Meyrin could be dropped from the basic programme provided no State supporting CERN-Meyrin objected.

Article III

Article III lays down the conditions of membership. Any of the countries which formed the original Conseil Européen pour la Recherche Nucléaire has the right to join the Organization. The only State now outside the Organization which qualifies under this condition is Yugoslavia, which had to withdraw from the Organization in 1962 though it retains the status of 'Observer'. (Poland and Turkey are also Observer States.) Any other State wishing to join needs the unanimous support of all the Member States.

The Member States have to state in which 'programmes of activities' they wish to participate and this, as mentioned above, has to include a basic programme. (Thus no State could join just to use the ISR.) The Council can lay down a minimum period of participation in a programme (to ensure for example, that no major contributor withdraws in the middle of an expensive construction programme) which is tied to a maximum expenditure. This second restriction is an important amendment pressed for by bodies responsible for the allocation of national resources in science, who need to be aware of their commitments well in advance. The restrictions *can* only be lifted if no participating State objects. But having met these obligations, a State can withdraw from a programme as from the end of the financial year following the one in which it announces its intention to withdraw.

Article IV-VI

Article IV simply states that the 'Organization shall consist of a Council and, in respect of each Laboratory, a Director General assisted by a staff.

Article V defines the Council and has some important amendments concerning the voting procedure. The Council is composed of not more than two delegates from each Member State (who may bring their advisers) and has to meet at least once a year. It has the tasks of

a) determing policy in scientific, technical and administrative matters
b) approving the programmes of activities
c) adopting budgets
d) reviewing expenditure and approving accounts
e) deciding on staff requirements
f) publishing an annual report
g) doing anything else necessary to fulfill the purposes of the Convention.

Each Member State has one vote and (apart from some important exceptions) decisions are taken by a simple majority. A State cannot vote on a decision concerning a programme in which it does not participate unless the decision affects a programme in which it does participate. It can also lose its vote if it is too far in arrears with its contributions.

In order to discuss a particular issue a majority of the States involved must be present, though decisions requiring a two-thirds majority could obviously only be taken if two-thirds of the States involved were present and in agreement. However, this arrangement does allow Council Sessions to take place with a restricted agenda and limited attendance. Thus Sessions could be called to tackle the problems of just one of the programmes of activities.

To assist it in its work, the Council may set up 'subordinate bodies'. Two of these, which have played a very important role in the progress of the Organization for many years, are specifically mentioned in the Convention — a Scientific Policy Committee and a Finance Committee. There would not be an SPC and an FC for each Laboratory but one of each to serve the whole Organization. A possible newcomer, which is given some emphasis, is a committee for the execution and co-ordination of the different programmes.

Article VI concerns the appointment and role of the Director General. A two-thirds majority of all Member States is needed for the appointement (or dismissal) of a Director General; there would be one for each Laboratory and they would be of equal status.

A Director General is the sole executive authority for his Laboratory but the Council may also delegate powers of appointment and dismissal of staff to, for example, an executive committee responsible for a particular programme or Laboratory. The Council also adopts the Staff Rules (a revised version of the Staff Rules for CERN-Meyrin was approved at the last Council Meeting).

Article VII

This Article lays down the rules concerning the financial contributions of the Member States. (The States finance, of course, only those programmes in which they participate.) Contributions are fixed on the basis of net national income and are adjusted every three years.

In fixing the contributions, the Council can take into account 'special circumstances' prevailing in a Member State. (Both Greece and Spain benefit from a reduction on this basis at present.) The revised Convention has incorporated a clause from the ESRO Convention which recognizes national income 'per capita' below a level to be decided by the Council, as a 'special circumstance'. This level will probably be set by the Council at the same time as the scales of contribution are fixed (once every three years). The adjustment, if any, to be granted to a Member State is left, as before, to the discretion of the Council.

In the existing Convention, the maximum percentage contribution that any Member State can be called upon to provide is 25 %. The revised Convention selects no figure but gives the Council the authority to fix the figure for any particular programme. In fact, when passing the new Convention, the Council immediately re-affirmed the 25 % rule which remains in force for all the programmes of activities, though it could now be changed if no participating country objects.

Any State wishing to join the Organization, or any Member State wishing to join a particular programme after it has started, can be called on for a special contribution to the capital cost already incurred.

A paragraph has been added to this Article to make financial provision for the participation of the Organization in a national or multi-national project. The same rules as above would apply unless the Council decides otherwise.

Attached to the Convention is the Financial Protocol which lays down the administrative details of financing the Organization. It covers such things as the presentation of budgets, the role of the Finance Committee, the currency in which contributions shall be paid (at present, that of the country in which the seat of the Organization is established — i.e. Swiss Francs), accounts and auditing.

Articles VIII - XX

The first seven Articles contain the essence of the CERN Convention. We will not consider the remaining Articles, many of which are now of historical interest only, in much detail but merely list them with an occasional remark on their contents.

Article VIII: The Organization shall co-operate with the United Nations Educational, Scientific and Cultural Organization'. This is a recognition of the role of fairy-Godmother which UNESCO played in setting-up CERN.

Article IX defines the legal status of the Organization.

Article X authorizes the Council to recommend amendments of the Convention to the Member States and it is in accordance with this Article that the present revision has been done. All Member States need to accept the amendments before they can come into force.

Article XI refers disputes not resolved by the Council to the International Court of Justice unless the States concerned agree another form of settlement.

Article XII concerns withdrawal from the Organization and has been mentioned above when discussing conditions of membership.

Article XIII gives the Council power to evict a State which is not fulfilling its obligations.

Article XIV dissolves the Organization if there are less than five Member States, or if the Member States agree to dissolve it, and makes provision for the disposal of any surplus or payment of any debt at the time of dissolution.

Articles XV and XVI are of historical significance (as are the other remaining Articles) — they opened the Convention for signature until 31 December 1953 subject to ratification, Instruments of ratification' being deposited with the Director General of UNESCO.

Article XVII allows any State fulfilling the conditions discussed above, to 'accede' to the Convention after 1 January 1954.

Article XVIII. The Convention entered into force when seven States (including Switzerland as the host country) providing 75 % of the total percentage contributions, joined the Organization.

Article XIX required the Director General of UNESCO to keep the European countries informed as each State joined the Organization.

Article XX required the Director General of UNESCO to register the Convention with the Secretary General of the United Nations when it entered into force.

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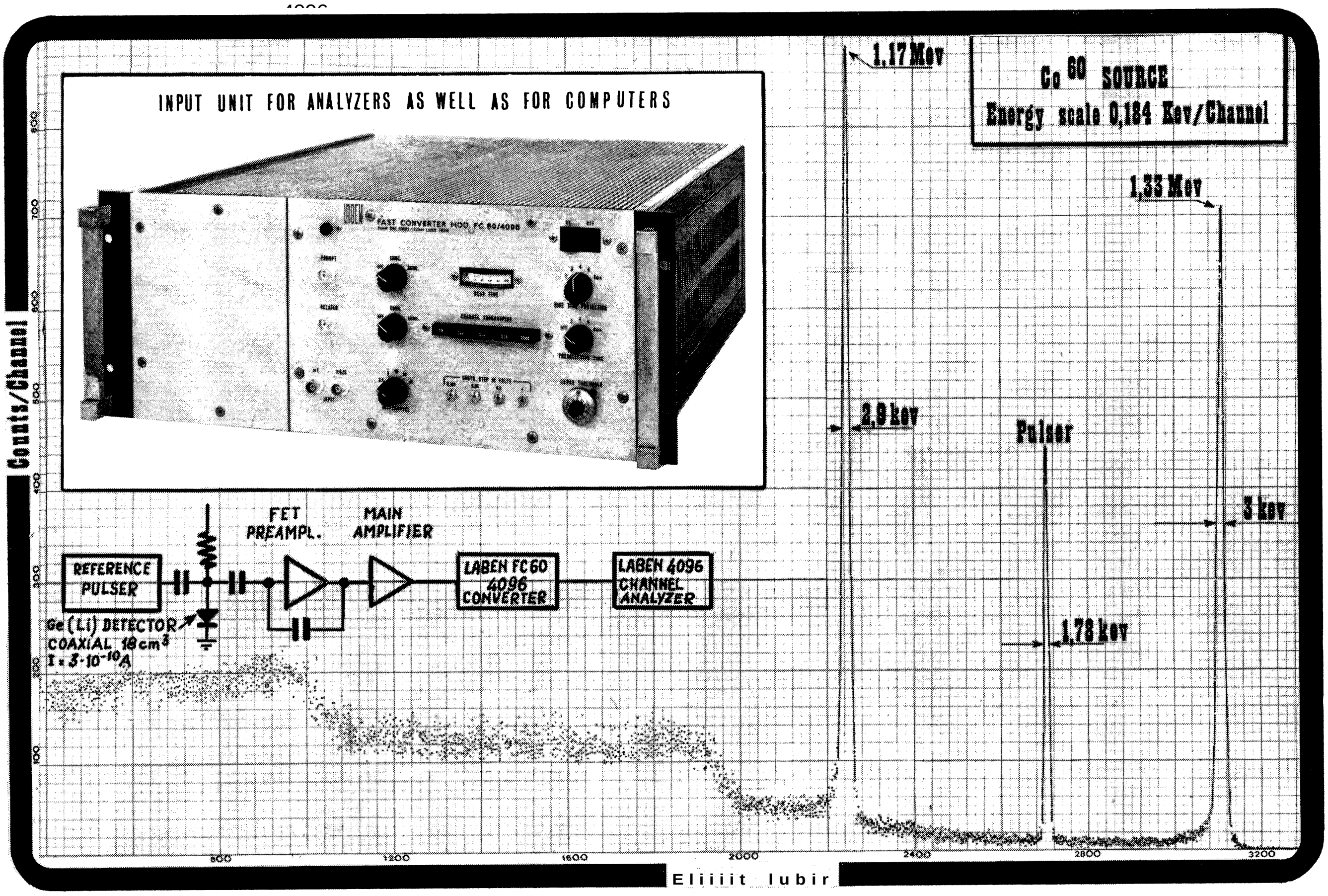

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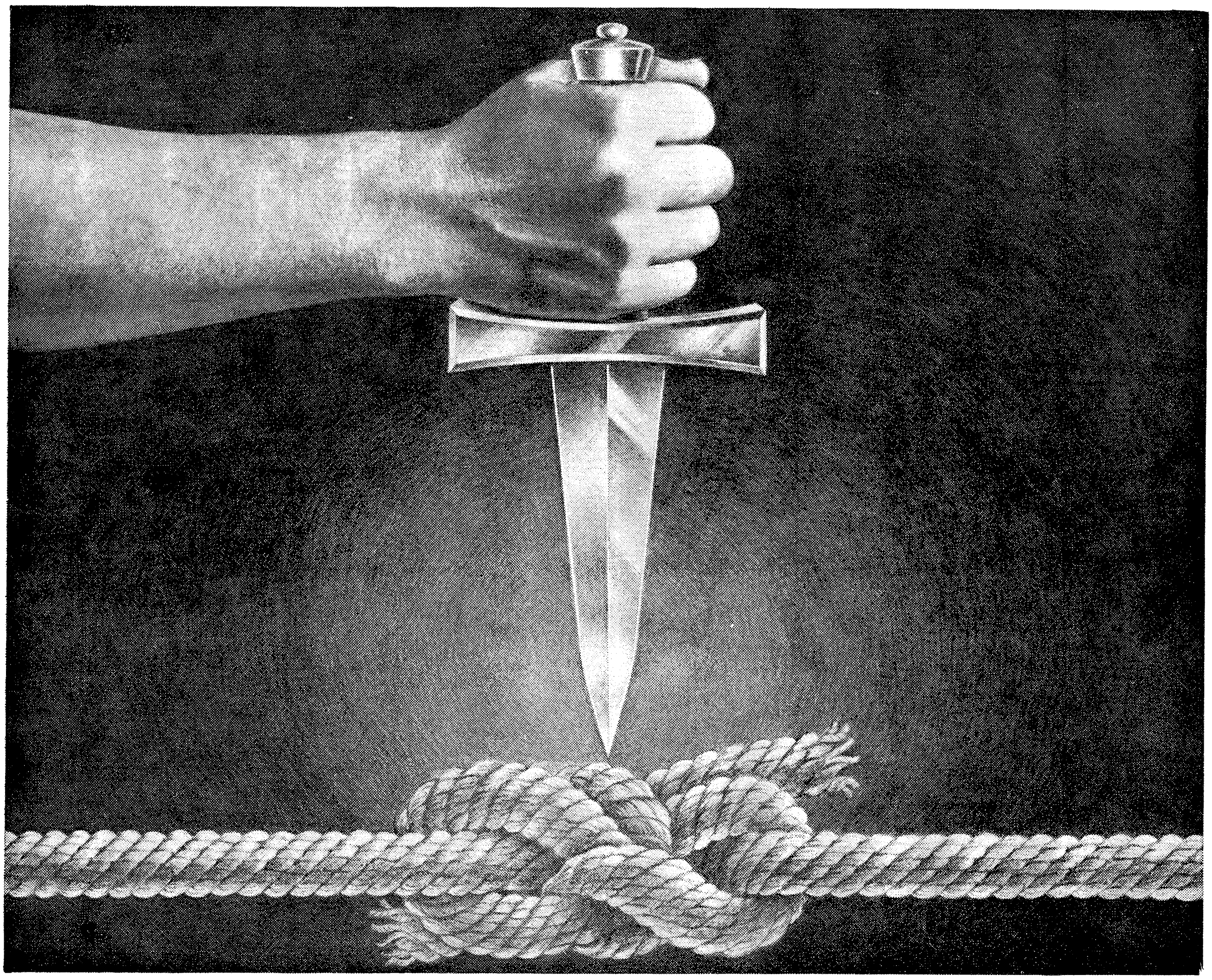

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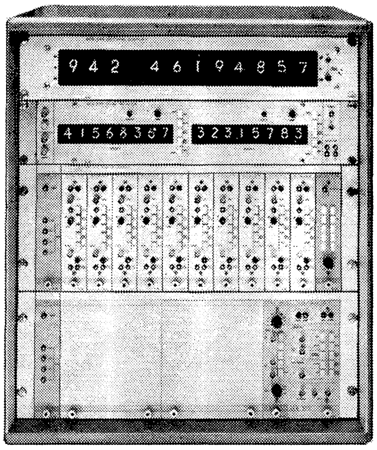

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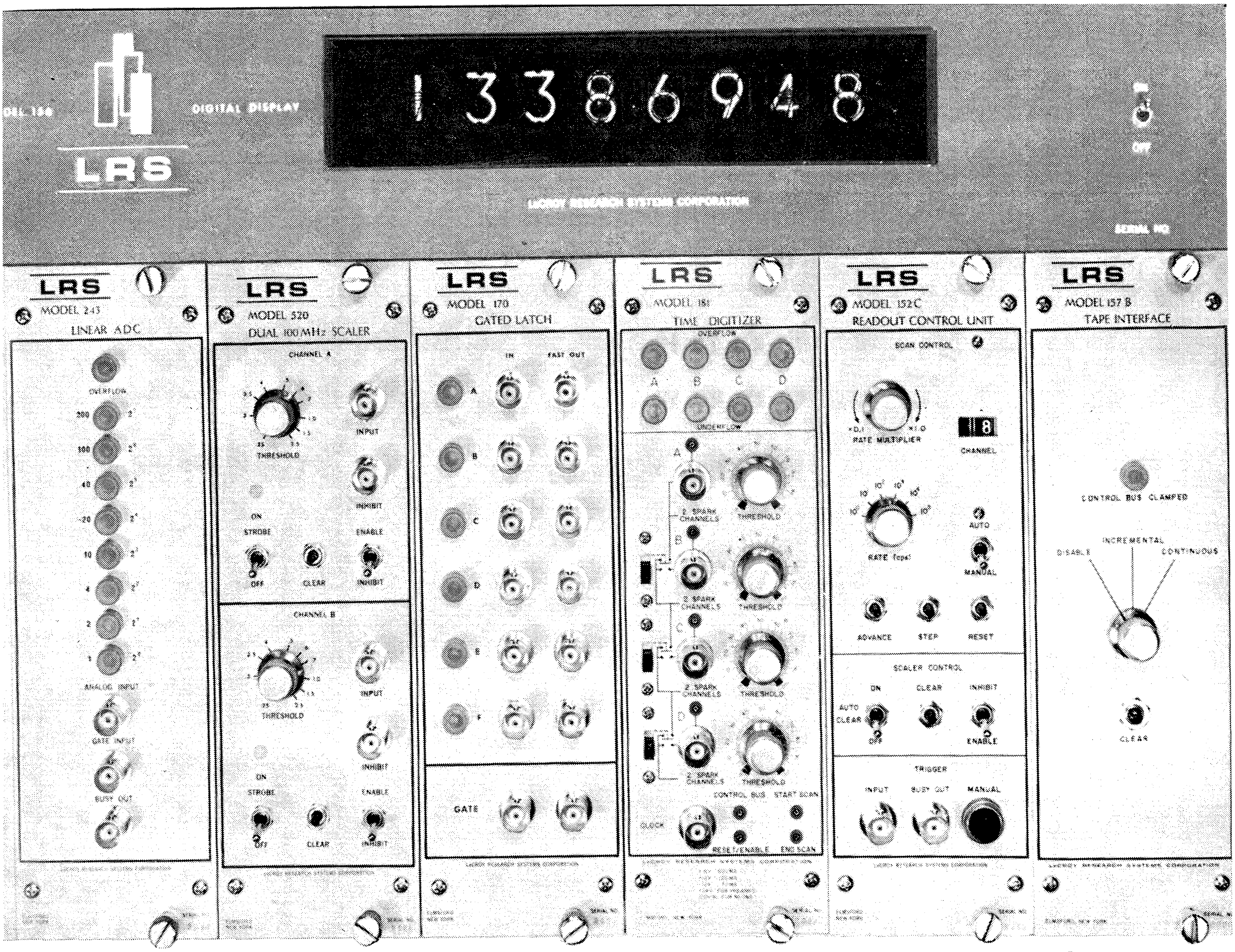

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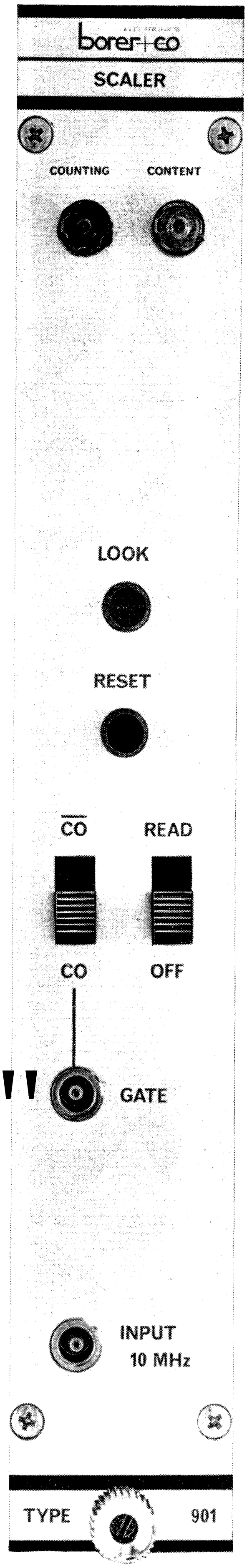

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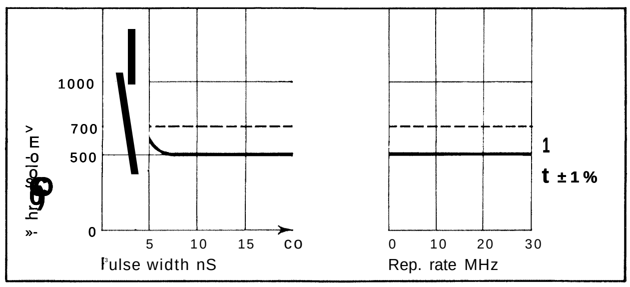

Many different types are available to meet your specific requirements.
Counting speed of 10, 30 or 100 MHz
with or without input discriminator
gating facilities, coincidence or anti-coincidence

Please ask for full technical literature !

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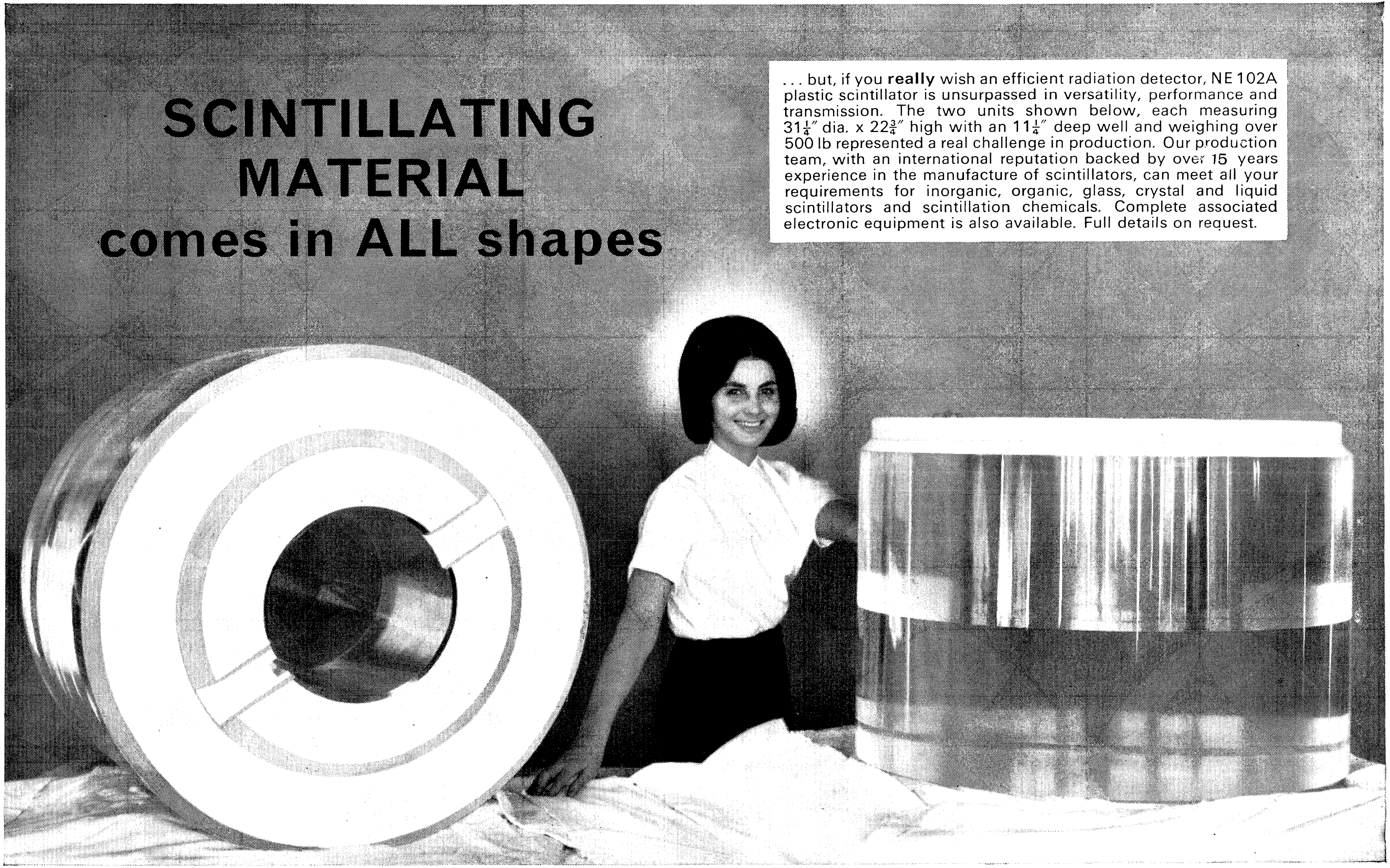

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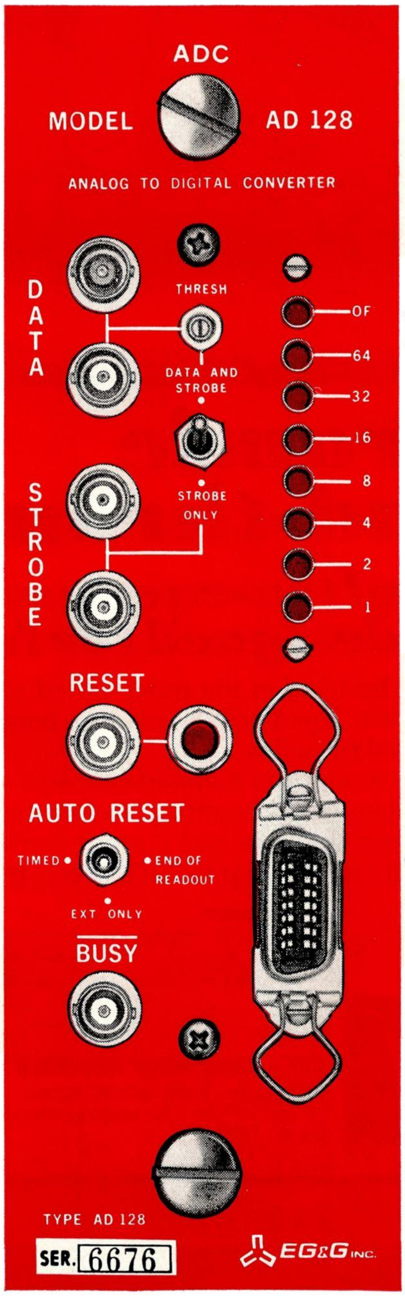

Seven-bit (128 channel) direct-coupled analog-to-digital converter.

Conversion time typically 12.9 μsec full scale.

Data input has full scale range 0v to +1.0v above threshold.

Adjustable threshold control for rejection of undesired low-level signals.

Strobe input accepts M100 System logic and complementary logic signals.

STROBE and RESET inputs accept M100 System logic and complementary logic signals.

Busy complement logic signal output controls external modules, or allows sequential conversion.

Available in both the EG&G package and in a NIM-compatible package (NBS-AEC TID-20893 rev.).

Visual readout provided for test purposes.

Internal control logic allows sequential reading of many AD128 units.

Seven-bit digital output; 8th bit for digital data or overflow reset signal.

Write or call for detailed specifications.

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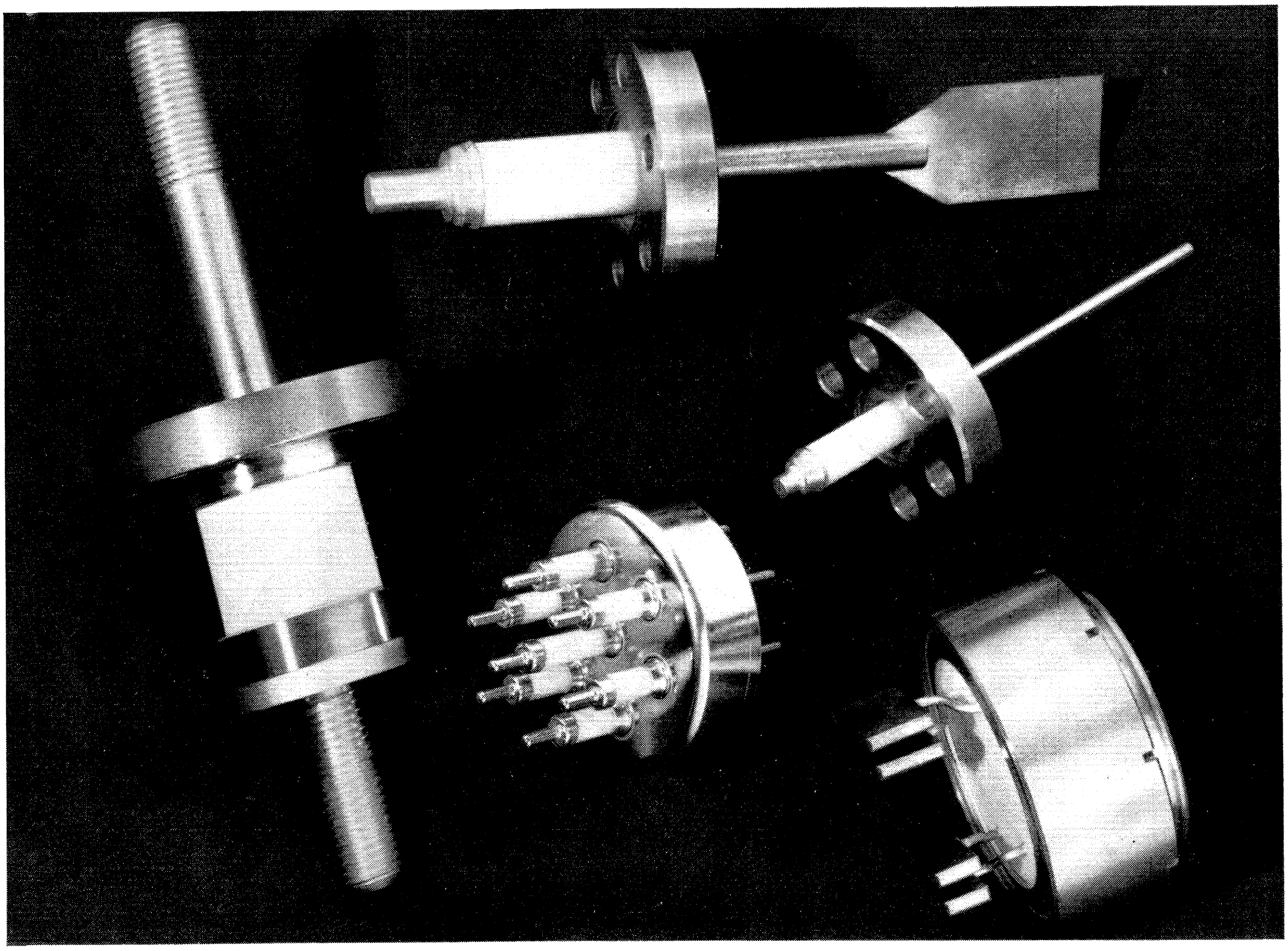

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