

CERN News

cross-section of 20 x 15 inches in a field of 15 kG) was regarded as an almost impossible monster when it was first proposed. Lawrence told Alvarez 'I don't believe in a big chamber at this time, but I do believe in you'. His faith was rewarded for in 1959 Alvarez and his colleagues brought the chamber into operation and it began physics in the Spring of 1960. Within the next two years it contributed results which marked a turning point in the development of particle physics.

This turning point concerned the discovery of resonances. One mysterious resonance had been found on the Chicago 450 MeV synchro-cyclotron in 1952 but it was the Alvarez group which showed that resonances are a general phenomena of particle physics. With the 72 inch chamber fed by the 6.2 GeV Bevatron, they found the first strange particle resonance Y^* (1385) and the first boson resonance K^* (893) and many others, so that they still have to their credit a very high proportion of the resonances so far identified.

In parallel with this bubble chamber work, Alvarez realized that new techniques would be needed to handle the huge volume of information that they could produce. As early as 1955 he tabled the basic parameters for semi-automatic measuring machines. Such machines were constructed and perfected, beginning with the 'Frankenstein' and now with the 'Spiral Reader'. Computer programs and techniques for the analysis of the output of these machines were also developed, particularly with the help of F. Solmitz.

Alvarez is currently leading two exotic projects. One is to X-ray the pyramids of Egypt using a spark chamber array to look at the cosmic ray muon flux. The purpose is to locate any hidden cavities in the pyramid structure which could be the sealed tombs of the Pharaohs. The second is HAPPE (High Altitude Particle Physics Experiment). Spark chambers with a superconducting Helmholtz coil to give complete magnetic analysis of events will be sent up in balloons to study the interaction of ultra-high energy cosmic rays (1000 GeV range) with particles in the upper atmosphere.

It is this life of achievement that has been recognized with the award of the Nobel Prize.

It works!

On 20 November, the seemingly unimpressive bubble chamber picture shown below was taken in a small glass chamber filled with liquid helium on a test rig in the South Hall. The story behind the picture makes it no longer 'unimpressive', for those bubbles represent an outstanding success which could eventually have a great impact on the world of particle detectors. The photograph shows the first charged particle tracks ever to be recorded in an 'ultrasonic bubble chamber'. The success was announced in NATURE on 21 December.

The principle of bubble chamber operation requires that a volume of liquid (ones typically in use being hydrogen, deuterium, helium, propane and freon) be subjected to a pressure cycle around the pressure at which it boils. Before a charged particle beam is fired into the liquid the pressure is released so that boiling can take place. The ionized particles that the beam particles leave in their wake form centres for

the formation of bubbles and therefore boiling takes place first (the bubbles of gas appear first) along the tracks of the charged particles. Photographs of these tracks can be taken before general boiling of the liquid occurs and the pressure reapplied ready for the next burst of particles.

The necessary variations in pressure have, up to now, been applied by bulky expansion systems involving compressors, pistons, diaphragms... Some idea of the scale of such systems can be gained from the descriptions of the two huge bubble chambers now under construction for CERN — the 3.7 m hydrogen chamber (CERN COURIER vol. 7 page 143) and Gargamelle, the heavy liquid chamber (CERN COURIER vol. 8 page 95).

It has been realized for many years that, in principle, it should be possible to use sound to do the job of applying pressure to a bubble chamber liquid. Sound is, by definition, a pressure disturbance travelling through a medium.

In order to have a sufficiently short



1. The first charged particle tracks ever to be recorded in an 'ultrasonic bubble chamber'.
2. The ultrasonic bubble chamber test rig in the South experimental Hall where it can receive particles from the PS. Notice the small window through which the photographs were taken and the polaroid camera on the right.

wavelength for bubble chamber operation ultrasound is needed. This means sound waves at a frequency higher than audible sound, higher than 20 kHz (not to be confused with 'supersonic' which refers to travelling faster than the speed of sound). Thus operation of an ultrasonic bubble chamber may disturb any nearby colony of bats but is not audible to the human ear. The techniques of producing ultrasonic waves have been known for many years and have found a wide variety of applications. For example, there has been extensive use for cleaning purposes where the pressure disturbance shakes the dirt off objects.

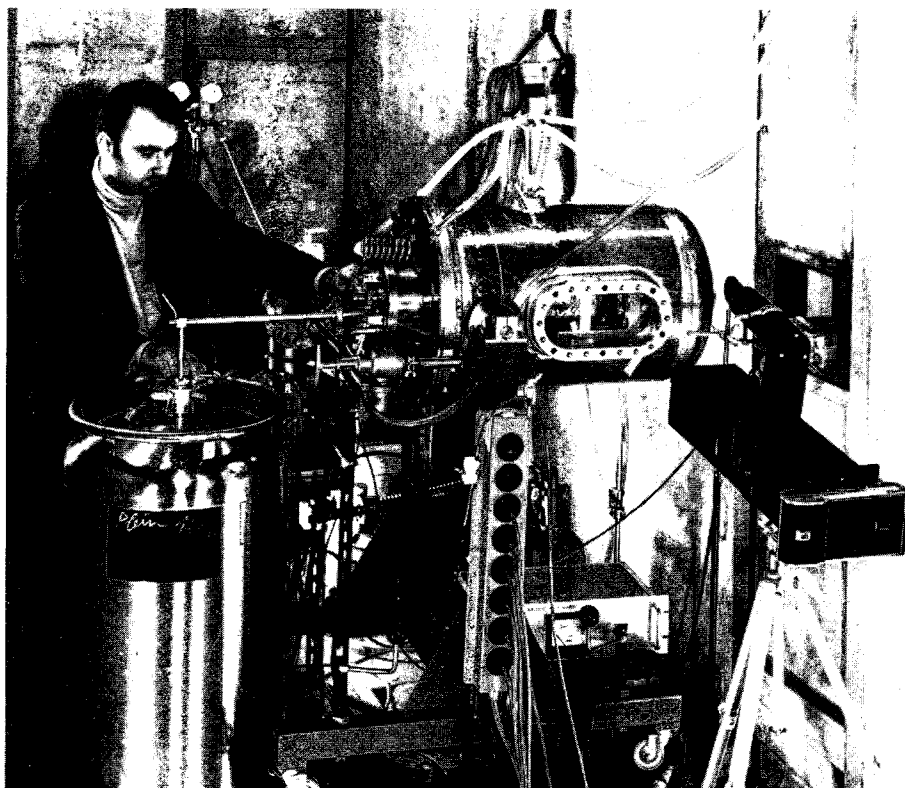
For about ten years, people have carried out research on ultrasonic bubble chambers. Work has been in progress in Japan, USA and USSR and at CERN under the late A. Schoch.

In 1966, an American scientist, A.H. Rogers came to CERN. He stirred up enough enthusiasm to mount a small scale effort with a helium chamber in C.A. Ramm's Nuclear Physics Apparatus Division. The scientists who worked with him, and who finally carried the effort to success when Rogers returned to Stanford a few months ago, were R.C.A. Brown and H.J. Hilke. (Hilke had previously tried ultrasonic operation with freon.)

Rogers (and also A.L. Hughes and Schoch) had pointed out that helium was the bubble chamber liquid most amenable to ultrasonic treatment, although with helium the cryogenic problems introduce more difficulties.

A small helium chamber was set up in the South Hall where it received pions and protons from the synchrotron. Inside the chamber are two piezoelectric crystals 7 cm in diameter, spaced 5 cm apart (this spacing can be varied up to 25 cm). The crystals generate the sound waves using the piezoelectric effect — an alternating potential difference applied across the faces of the crystal causes it to change its physical dimensions, thus sending out pressure waves. In the bubble chamber, the frequency at which this occurs is 110 kHz.

The spacing of the crystals and the



CERN/PI 185.11.68

selection of the frequency is such that 'standing waves' are set up between them. This means that if the pressure is examined across the chamber from one crystal to the other there are, separated by a distance about 0.5 mm, positions where the pressure disturbance is zero and positions where the pressure disturbance is maximum, swinging alternately above and below the static pressure applied in the chamber.

This static pressure is set very closely above the pressure at which the helium boils. When the sound wave is switched on, the pressure in half of the regions of maximum disturbance swings below the boiling pressure and, if charged particles have created ionization in these regions bubbles are formed. (Perhaps it will help to grasp this idea to notice that in the photographs the lines of bubbles are not continuous as in the conventional chamber but are broken into little segments corresponding to the regions which were sensitive to bubble formation.)

The big unresolved question was whether normal beam particles from an accelerator, which cause comparatively low ionization in the liquid, would be able to produce bubbles of sufficient size before the pressure swings into the opposite direction. It was possible that low ionizing particles would yield too small bubbles which would be snuffed out of existence when the pressure swing occurred. The bubbles are far too tiny to be photographed before this pressure swing and in fact they have to exist for some fifty to sixty pressure cycles before they have grown to visible dimensions. The vital answer from the CERN experi-

ments is that it is possible to grow visible bubbles.

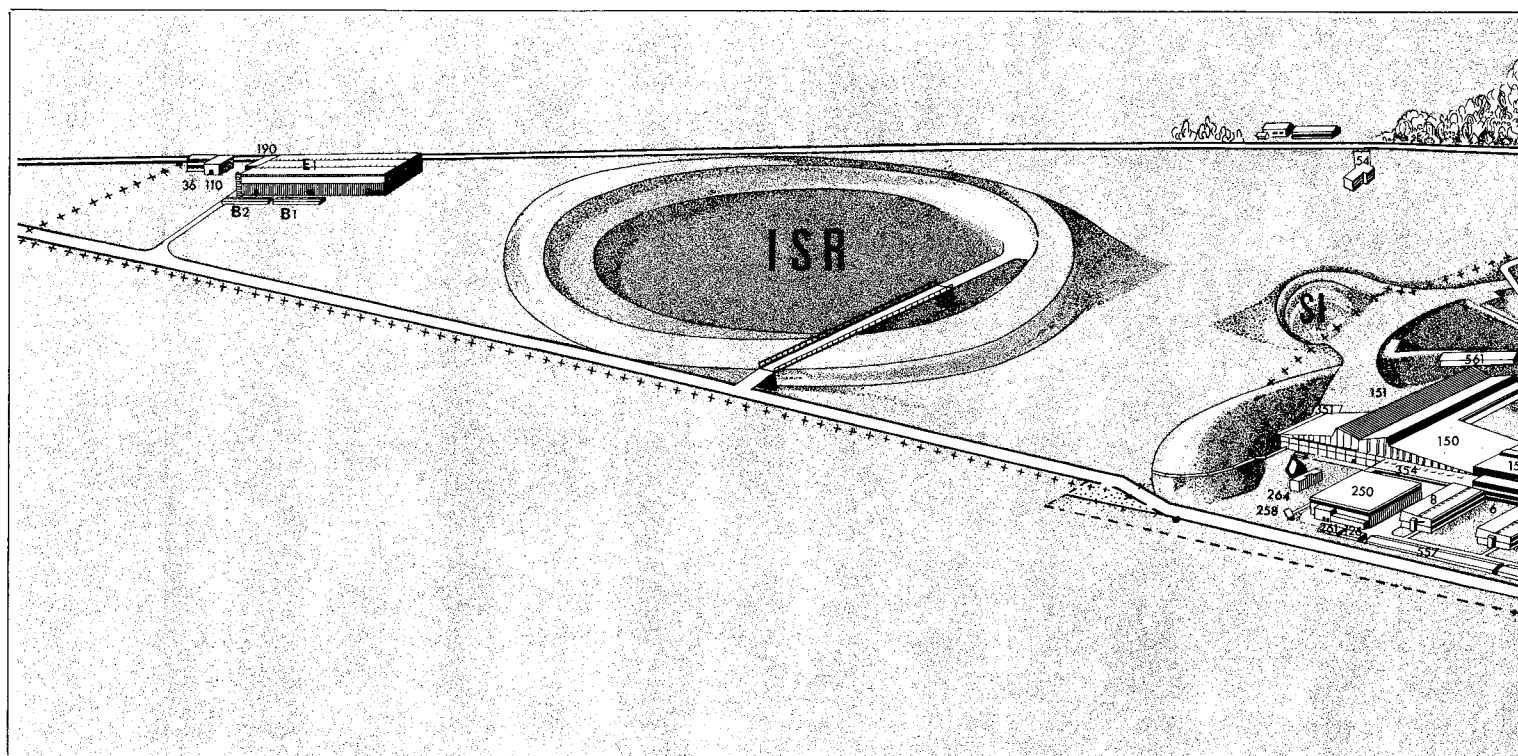
A great deal of work to refine techniques, to establish optimum operating conditions and so on, needs to be done before ultrasonic chambers can appear as standard items of particle detection systems, but the attack on the problem is likely to be greatly intensified now that it has been shown, at last, that the principle works.

There are several advantages to be gained from perfecting the ultrasonic chamber. The large pressure systems would be replaced by crystals which might make it possible to cycle the chamber extremely rapidly. Existing pressure systems can only with difficulty cycle more than a few times per second (see for example the information on the excellent achievement at Argonne where a large chamber has been pulsed five times in one accelerator cycle — page 312). But the ultrasonic chamber could potentially be almost continuously sensitive. It could for example be used as the detector/target, to give precise information on the vertex of an event, in conjunction with a counter system which would control the flash so that only photographs showing the interesting events would be taken.

The possibilities using an ultrasonic chamber will no doubt emerge more fully as the technique is progressively mastered. C.A. Ramm summed this up very nicely when announcing the success to his Division. He quoted Benjamin Franklin's reply to someone questioning the use of a new invention... 'What is the use of a new born baby?'

Perspective view of CERN

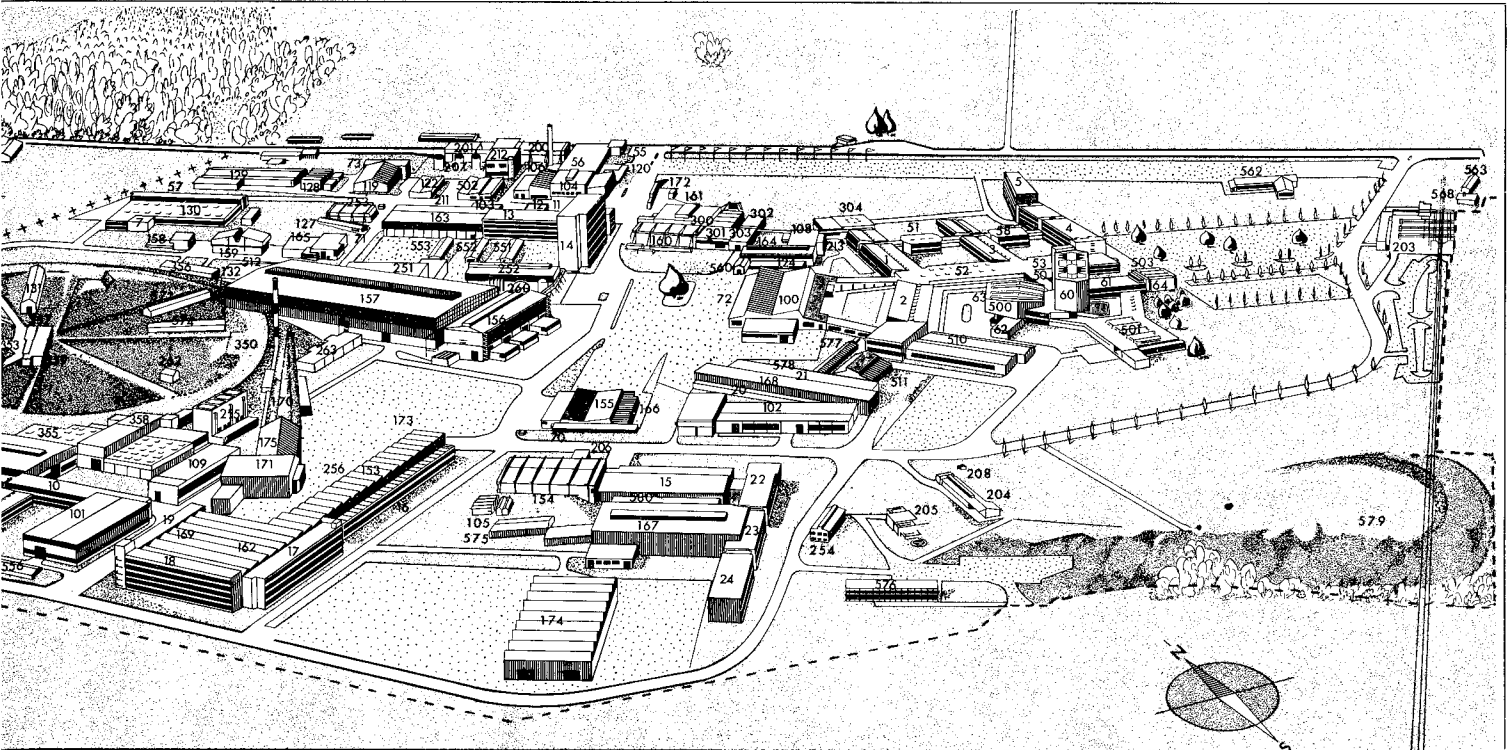
up to date on 1 January 1969



Dénomination ou utilisation	Numéros des blocs Block number	Name or purpose	Dénomination ou utilisation	Numéros des blocs Block number
Aile de laboratoires 1	1	Laboratory wing 1	Réception des marchandises	120
Aile de laboratoires 2	2	Laboratory wing 2	Magasin du bois	122
Aile de laboratoires 3	3	Laboratory wing 3	Magasin central de produits chimiques	124
Aile de laboratoires 4	4	Laboratory wing 4	Magasin de produits chimiques du PS	126
Aile de laboratoires 5	5	Laboratory wing 5	Magasin de bouteilles d'hydrogène du HL	127
Aile de laboratoires 6	6	Laboratory wing 6	Entrepôt	128
Groupe sécurité du travail	7	Safety group	Hall de stockage	129
Aile de laboratoires 8	8	Laboratory wing 8	Garage	130
Aile de laboratoires 9	9	Laboratory wing 9	Stockage de câbles	131
Aile de laboratoires 10	10	Laboratory wing 10	Magasins de stockage	132
Aile de laboratoires 11	11	Laboratory wing 11	Hall expérimental sud du PS	150
Aile de laboratoires 12	12	Laboratory wing 12	Hall expérimental nord du PS	151
Aile de laboratoires 13	13	Laboratory wing 13	Extension du Hall expérimental sud du PS	152
Aile de laboratoires 14	14	Laboratory wing 14	Hall de montage du bâtiment NPA	153
Aile de laboratoires AR	15	Laboratories of AR building	Hall expérimental du bâtiment AR	154
Aile de laboratoires NPA	16	Laboratories of NPA building	Hall expérimental (Adams Hall)	155
Extension aile laboratoires NPA	17	Extension to laboratories of NPA building	Bâtiment expérimentation des C. à B. (EBCB)	156
Aile de laboratoires NPA	18	Laboratories of NPA building	Hall expérimental est - (Apron)	157
Aile de laboratoires NPA	19	Laboratories of NPA building	Bâtiment No 1 pour essais de cibles à hydrogène	158
Laboratoires NP	20	NP laboratories	Bâtiment No 2 pour essais de cibles à hydrogène	159
Laboratoires NP	21	NP laboratories	Hall d'expérimentation des faisceaux de neutrons du SC	160
Extension aile laboratoires AR	22	Extension to laboratories of AR building	Hall d'expérimentation des faisceaux de protons du SC	161
Nouveaux bureaux + laboratoires AR	23	New offices and laboratory for AR Division	Extension Hall NPA	162
Nouveaux bureaux + laboratoires Physique de Santé	24	New offices and laboratory for Health Physics Group	Hall expérimental TC	163
Laboratoires et bureaux B.E.B.C.	36	B.E.B.C. laboratories & offices	Hall MSC	164
Passerelle	50	Footbridge	Bâtiment Cryogénie	165
Bureaux	51	Offices	Extension Hall AH (Adams Hall)	166
Aile de la bibliothèque	52	Library wing	Nouveau Hall AR	167
Aile de la division Théorie	53	Theory Division wing	Hall de montage NP	168
Bâtiment SB	54	SB building	2e extension Hall NPA	169
Bureaux SB	55	Offices of SB Division	Neutrino	170
Extension des bureaux SB	56	SB office extension	Gargamelle	171
Bureaux SB	57	Offices of SB Division	Isolde	172
Centrale téléphonique et bureaux	58	Telephone exchange and offices	Station de contrôle Neutrino	173
Secrétariat de l'administration	60	Administration secretariat	Hall FK11	175
Aile de la salle du Conseil	61	Council Chamber wing	Hall de liaison (E2) B.E.B.C.	190
Aile du bâtiment administratif (sud)	62	South wing of Administration building	Hall chambre à bulles	191*
Aile du bâtiment administratif (nord)	63	North wing of Administration building	Hall Exploit. (BE) B.E.B.C.	192*
Bureaux P.I.O. - Informations	64	Public Information (PIO)	Bâtiment de la centrale de distribution (PH)	200
Bureaux de l'Adams Hall	70	Offices of Adams Hall	Extension Centrale PH	201
Bureaux du bâtiment HL	71	Hydrogen liquefier offices	Sous-station électrique principale 130/18 kV	203
Bureaux et Atelier A.P.	72	Main workshop and offices	Station de pompage et réservoir d'eau	204
Bureaux des magasins	73	Stores offices	Station d'épuration des eaux usées	205
Atelier principal avec ses ailes d'accès nord et sud	100	Main workshop with north and south access corridors	Bâtiment sous-station électrique zone sud-est	206
Atelier Ouest	101	West workshop	Réservoirs à mazout	207
Atelier de traitements de Surfaces	102	Surface treatment shop	Chambre des vannes et de l'accumulateur au départ du réseau d'eau de réfrigération	208
Atelier de la Division TC	103	Workshop of TC Division	Sous-station Labo 13	211
Atelier d'entretien de la Division SB	104	Maintenance workshop of SB Division	Sous-station Jura	212
Atelier de la Division SB au PS	105	PS workshop of SB Division	Sous-station SC	213
Annexes atelier SB	106	Annexes to workshop of SB Division	Réservoir d'eau zone ISR (PST)	226*
Atelier SC	108	SC workshop	Château d'eau (WT)	227*
Atelier MPS	109	MPS workshop	Bâtiment des génératrices sud (GBS)	250
Atelier de montage B.E.B.C.	110	B.E.B.C. assembly workshop	Bâtiment des génératrices est (GBE)	251
Magasins de stockage	119	Stores		

Plan perspectif du CERN

à jour au 1 janvier 1969



Name or purpose	Dénomination ou utilisation	Nombres des blocs	Name or purpose
		Block number	
Goods reception	Bâtiment des compresseurs (ECB)	252	Compressor building (ECB)
Wood stores	Bâtiment de préparation hydrogène liquide (HL)	253	Hydrogen Liquefier building (HL)
Central chemical stores	Bâtiment de distillation du propane	254	Propane distillation building
PS chemical stores	Tours de réfrigération	255	Cooling towers
Store for hydrogen cylinders	Station des génératrices du bâtiment NPA	256	Generator room for NPA building
Intermediate store	Abris des dewars d'hydrogène liquide	258	Shelters for liquid hydrogen containers
Storage Hall	Sphère de sécurité	260	Safety sphere
Garage	Annexe Générateur sud	261	Annex to South generator building
Cable store	Stockage propane	262	Propane storage building
Stores	Bâtiment redresseur No 3	263	No 3 rectifier building
PS south experimental Hall	Hall Compr. (HE) B.E.B.C.	276*	B.E.B.C. compressor room (HE)
PS north experimental Hall	Hall Compr. (H2) B.E.B.C.	277*	B.E.B.C. compressor room (H2)
Extension to PS south experimental Hall	Bâtiment abritant le synchro-cyclotron	300	Synchro-cyclotron building
Equipment hall, NPA building	Salle d'équipement de l'appareillage auxiliaire	301	SC equipment room
Experimental hall, AR building	Bâtiment des génératrices auxiliaires	302	Auxiliary generator building
Experimental hall, (Adams hall)	Bâtiment des équipements de radio-fréquence	303	RF equipment building
Experimental bubble chamber building (EBCB)	Bâtiment de la salle de contrôle et de comptage	304	Control and counting rooms
East experimental hall (Apron)	Anneau du Synchrotron à protons	350	Proton-synchrotron ring
Building No 1 for testing hydrogen targets	Bâtiment de l'accélérateur linéaire (Linac)	351	Linac building
Building No 2 for testing hydrogen targets	Bâtiment central	353	PS central building
SC neutron room (experimental hall)	Bâtiment de la salle de contrôle et de comptage	354	Main control room and counting rooms
	Bâtiment de la génératrice principale et annexes	355	Main generator building and annexes
	Bâtiment Ejection est	356	East ejection building
	Extension bâtiment central	357	Extension to PS central building
	Extension bâtiment génératrice principale PS	358	Extension to main PS generator building
	Elanceur	360*	Booster
	Annexe élanceur	361*	Booster annex
	Amphithéâtre du bâtiment d'Administration	500	Auditorium and entrance hall of Administration building
	et Hall d'entrée		
	Restaurant et cafétéria	501	Restaurant and coffee lounge
	Salle du Conseil	503	Council Chamber
	Bâtiment de la calculatrice CDC 6600	510	CDC 6600 computer building
	Baraque Wilson	511	Wilson hut
	Bâtiment contrôle zone est	512	East area control building
	Baraque 2	551	Hut 2
	Baraque 3	552	Hut 3
	Baraque 4	553	Hut 4
	Baraque 6	556	Hut 6
	Baraque 7	557	Hut 7
	Baraque 11	560	Hut 11
	Baraque 12	561	Hut 12
	Cantine CERN No 2	562	CERN canteen No. 2
	Baraque E	563	Hut E
	Chauffage et douches des dortoirs	568	Heating plant and showers for dormitories
	Baraque de stockage	573	Stores hut
	Baraque MPS	575	Hut for MPS Division
	Jardin d'enfants	576	Nursery school
	Baraque Bureau DD	577	Hut, office for DD Division
	Baraque Bureau DE	578	Hut, office for DD Division
	Baraques d'entreprises	579	Contractors'huts
	Baraque ISR	580	ISR hut
	Hall Ouest	E1	West Hall
	Bureaux provisoires ISR	B1	ISR hut
	Bureaux provisoires ISR	B2	ISR hut
	* En projet		* To be built



Switzerland joins

On 10 December, the President of the Swiss Confederation, Mr. Willy Spühler, forwarded a letter to the President of the CERN Council, Dr. G.W. Funke, announcing that Switzerland is prepared, in principle, to participate in the construction of the 300 GeV accelerator. Thus Switzerland joins five other European countries — Austria, Belgium, Federal Republic of Germany, France and Italy — who have already sent 'Letters of Intent'.

The Swiss decision is subject to ratification by parliament, possibly following a referendum, and to a ceiling on its financial contribution, which is based on the participation of the six countries who have so far agreed, and on a maximum expenditure of 1335 million Swiss francs (1967 prices). At the same time the letter expresses the hope that more countries will agree to participate.

The decision was motivated particularly by the wish to sustain the outstanding European co-operation achieved in the field of high energy physics which has produced such fruitful relations between CERN Meyrin and national research centres.

Position of Spain *

At the beginning of November, it was learned that Spain would have to withdraw from the European Organization for Nuclear Research with effect from the end of 1968. A provisional warning that this might prove necessary had been received from the Spanish government at the beginning of August. As reported in CERN COURIER, page 237, the Council at its October meeting had agreed to a reduction in the contribution of Spain for the coming years (to 50% of the nominal proportion) but the government still did not feel able to continue its support.

In his letter conveying the news to the Director General, Sr. Enrique Perez Hernandez, the permanent delegate of Spain to the CERN Council, stressed that the reasons for his government's decision are exclusively the result of prevailing financial difficulties. The government recognizes without the least reserve both the usefulness and efficiency of CERN and still

regards CERN as an Organization of the highest value. The government also recorded its appreciation of CERN's contribution to the development of nuclear science in Spain over the past years.

Spain has been a Member State of CERN since January 1961. Its contribution to the budget over the past three years was 3.43%. Over the past few years several strong high energy physics groups have grown up in Spanish Universities and research centres.

ISR Users Meeting

On 23 December, the second major gathering of physicists from throughout Europe who are interested in experimentation on the Intersecting Storage Rings was held at CERN. The purpose of these meetings has been to enable the physicists to participate in the discussions from which will eventually evolve the initial experimental programme at the ISR. As at the first meeting in June (see CERN COURIER vol. 8 page 128), over a hundred scientists came from outside CERN.

A further indication of the great interest in using the ISR is that 29 research centres from 10 Member States have sent 'Letters of Intent' (not to be confused with Letters of Intent to join the 300 GeV project which have not arrived quite so quickly or in such profusion) expressing desire to carry out colliding beam experiments. Some of these letters contain proposals for experiments which are fairly fully worked out. Several possible experiments had already been discussed by physicists from CERN itself at the June meeting. The December meeting was therefore predominantly concerned with discussion of proposals from other European groups.

The decisions as to which of these experiments should be mounted on the ISR ready for first operation in the summer of 1971 need to be taken quickly so as to give at least two years for their preparation. To this end, the meeting discussed the organization of the experimental programme and decided to establish an ISR Experimental Committee (ISRC) which will be similar in structure and in purpose to the Committees which have served so well in the organization of the experimental programme of the proton synchrotron.

Professor W. Jentschke was chosen as the Chairman of the ISRC.

It is the ISRC which will receive and judge the proposals for experiments and will make recommendations as to which experiments should be accepted to the Nuclear Physics Research Committee. The NPRC then takes the final decisions, taking into account the overall CERN experimental programme and the available resources.

It is intended that the ISRC will have a maximum of twelve members chosen from outside groups, from physicists at CERN and from ISR machine specialists. As with the other committees, individuals will serve for a few years and then make way for others.

Another urgent decision concerns the choice of a large, general purpose magnet system which will be installed in one of the two interaction regions which will be initially equipped for experiments. Three systems have been proposed and their relative merits were discussed at the meeting.

Professor Gunnar Källén

Professor Gunnar Källén, of the University of Lund (Sweden), died on 13 October in an air accident near Hannover. With his tragic death, Europe loses one of its most eminent theoretical physicists and CERN loses an excellent friend and supporter.

Born in 1926, Källén had a brilliant and rapid scientific career. He studied in Sweden, initially in electrical engineering but afterwards turning to physics. He was soon attracted by profound problems requiring advanced mathematical methods and quantum electrodynamics proved to be the field of his major scientific achievements in the years 1945-1955. He concentrated mainly on developing a new approach to the theory of renormalization which was, at that time, perhaps the most important topic in theoretical physics. His method differed from that of others working in the field in two major respects. First, he systematically used the Heisenberg picture instead of the so-called interaction representation. Even more important was his emphasis on the use of exact relations, i.e. relations which should be satisfied by the exact solutions of the field equations. In this way, he was able to formulate

precisely and attempt to answer the question of the infinity of the renormalization constants.

In Källén's work of this period were many ideas and techniques, in a more or less developed form, which have subsequently acquired fundamental importance in the application of field theory to particle physics. His early use of the spectral representations, of the reduction formulas and of what later came to be known as dispersion theory techniques, all have, directly or indirectly, basically affected the development of strong interaction theory.

Källén's work in quantum electrodynamics led him to be one of the first to study exact analyticity properties implied by the general principles of local field theory, and he obtained important results in collaboration with A. Wightman and J. Toll. Also worthy of mention was the importance for the theory of renormalization of the work done by Källén and Pauli on the Lee model, where they discovered the possibility of 'ghost' states (i.e. bound states corresponding to particles appearing with a negative probability).

Källén did not limit himself to the development of general theory, but used his own methods to obtain the solution of difficult concrete problems, as in the calculation of the fourth order vacuum polarization. After accepting a chair of Theoretical Physics at the University of Lund, he showed keen interest in experimental particle physics and the experimentalists at the Lund electron-synchrotron profited greatly from his advice. As a University Professor, Källén built up in Lund an active group of young theoreticians which he introduced into his critical and profound approach to research.

He was also keenly interested in the development of European collaboration in physics. After having been for a few years a member of the early Theory Group of CERN working in Copenhagen, he kept in contact with the Theory Division of CERN in Geneva where he spent the summer of 1967. He also represented Sweden on the European Committee for Future Accelerators, and it is when flying down to Geneva for the ECFA meeting of 14-15 October that he died in a plane accident.

Safety Group

Although small in number (16 people), the Safety Group is of importance to all members of CERN, for it supervises the application of safety standards on the CERN site, on behalf of the Directorate. How well it fulfils its role as 'guardian angel' can be seen clearly from the graph at the end of this article.

The Safety Group operates —

- a. By laying down safety standards which are generally based on national standards in force in the Member States or in the USA, or on international standards.
- The draft standards drawn up by the Group are discussed at meetings of specialists such as the Electrical Co-ordination Committee or the Hydrogen Working Committee, on which the relevant Divisions are represented. A definitive text is then established and passed to the CERN Safety Committee, which has representatives of all the Divisions. In its turn, this Committee submits the text to the Directorate for final approval.
- b. By publishing safety bulletins drawing attention to matters of general importance.
- c. By acting as an advisory body on safety matters for the Directorate, the Divisions and the personnel.
- d. By supervising installations, equipment and working methods from the point of view of safety, and in certain cases, by being directly responsible for applying safety standards.
- e. By carrying out destructive or non-destructive tests on materials.
- f. By helping the industrial medical officer to obtain the best possible working conditions and by checking to see whether medical restrictions applied to the work of certain staff are being observed.

Organization

The Group is divided into three sections — industrial safety; dangerous fluids and fire prevention; technical checking and inspection.

Industrial safety section:

This section is responsible for safety in

the electrical field, in the workshops, in civil engineering, in the experimental areas, and for industrial health. It lays down standards and is responsible for carrying out periodic inspections. It also has the task of checking new installations when they are started up (and, in some cases, has acceptance tests made).

Dangerous fluids and fire prevention section:

This section is concerned with safety in the use of dangerous liquids and gases, especially in the bubble chambers, the liquid hydrogen targets and the Cherenkov counters. It draws up standards, provides advice on the construction of installations and buildings, and supervises their application. Where fire prevention is concerned, it examines the available means of preventing explosions and of quickly extinguishing fires at their source and stipulates what fire-fighting equipment is necessary.

Technical checking and inspection section:

Because of the special statutes of CERN, no external body is responsible for making checks on the site. This task is therefore carried out by this section, at least where lifting equipment, tanks and pressurized systems, and the quality control of materials are concerned. All new installations are inspected before being taken into service and an approval certificate is issued when such installations are delivered. The section also has a laboratory for carrying out destructive and non-destructive tests on material.

Recent Standards

Two standards put forward by the Safety Group came into force during 1968.

The first deals with push-buttons and pilot lamps showing whether machines are in operation or not. There used to be some confusion due to the often contradictory provisions of national standards. In order to eliminate this confusion, CERN adopted, from the beginning of 1968, the standards of International Electrotechnical Commission, in force since July 1967. The result of this is that:

- a. all installations must be fitted with red 'stop' push-buttons and green 'start' buttons.

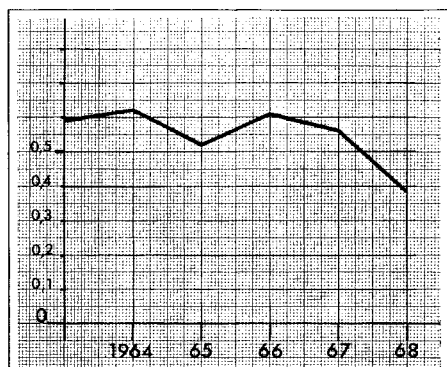
The graph shows the variation in accident rate at CERN in recent years. (An 'accident' for this purpose is defined as an accident which prevents a person working for at least two days.) The figures record the number of accidents per 100 000 manhours worked. The rate compares favourably with other research centres.

b. pilot lamps for electrical components must show a red light when a piece of equipment or a circuit is live, and a green light when it is 'dead'.

The second standard deals with the colour of electrical connector wiring. When CERN was founded, there were no strict rules on this subject, and customs were not uniform even inside individual countries. CERN therefore made its own arbitrary rules, stipulating that green and violet should be used for the live wire, grey for neutral and black for earth. Since then, however, several countries have adopted black to indicate the live wire. Also, CERN wished to bring its standards into line with those in France, which are stricter in some respects than those of the Swiss Association of Electricians (although the latter nevertheless remain the basic rules used at CERN).

After discussions, involving representatives of interested Divisions and experts appointed by the Swiss and French authorities, it was decided to adopt the international standard CEI 173 with regard to the colour of the earth wire (yellow and green) and the French standard which, regarding the neutral wire as a live conductor, requires that installations must contain a device whereby this wire can be disconnected from the mains. A recommendation has been made that black be avoided for the live wire in all CERN equipment or, where this is impossible, that the end of the wire be colour-coded differently.

In conclusion, it is appropriate to point out that the Safety Group is available to all personnel for help in solving any problem.



Generator sets

Because of the extension of the CERN site and the construction of the ISR, and also because of the increase in the number of other installations at CERN, it has become necessary to provide higher-powered emergency motor-generator sets. These will ensure that the most important services and equipment and certain essential auxiliaries to the accelerators (such as the vacuum pumps) the lighting system, ventilation and heating equipment, etc., will still operate if there is a breakdown in the mains supply.

The diesel engines of the two new sets (see CERN COURIER, vol. 8, page 206) have just been installed and on-load testing will begin in January. They increase the emergency electric power from 1320 to 7650 kVA, which is more than 20 % of the present peak consumption.

There are now three sets installed and one of them will operate permanently, in synchronism with the ordinary mains supply. This means that switch-over will be instantaneous, whereas, previously, bring-

ing in the emergency set took at least eleven seconds.

The main features of the two new sets, which are identical are :

Diesel engines

Manufacturer	Klockner-Humboldt-Deutz
Rated power	3500 HP ; four stroke
Speed	• 428 rev/min
Number of cylinders	12 in Vee
Bore	400 mm
Stroke	500 mm
Exhaust turbo-compressor manufacturer	BBC
Fuel	heavy oil
Starting device	compressed air

Alternator

Manufacturer	Siemens
Rated power	3200 kVA
Voltage	6300 V (three phase)
Cos Φ	0.8
Frequency	50 Hz
Excitation	390 A — 85 V

Natural and syntetic rubber
Plastic materials
Power transmission elsmments
Sealing specialists (GACO)

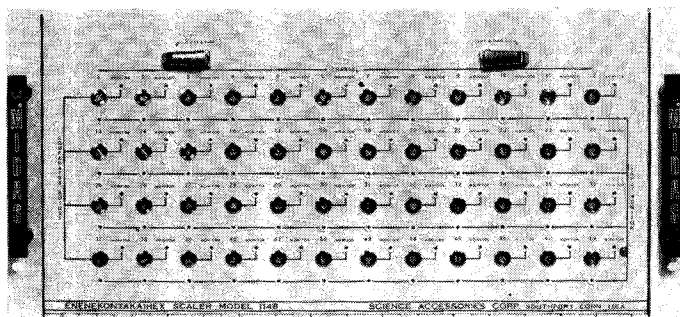
Agents & distributors :

Angst+Pfister

GENEVA
 ZURICH
 MILANO

from SAC...

DATA ACQUISITION SYSTEMS FOR HIGH ENERGY PHYSICS

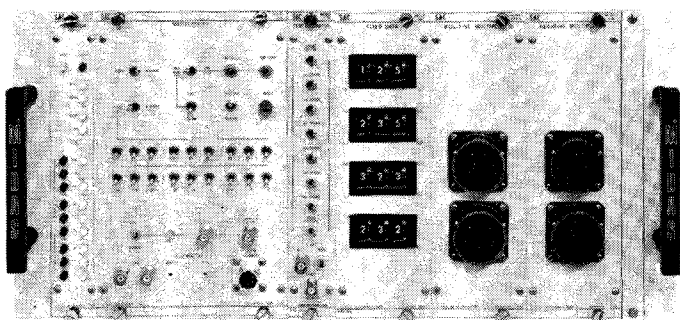
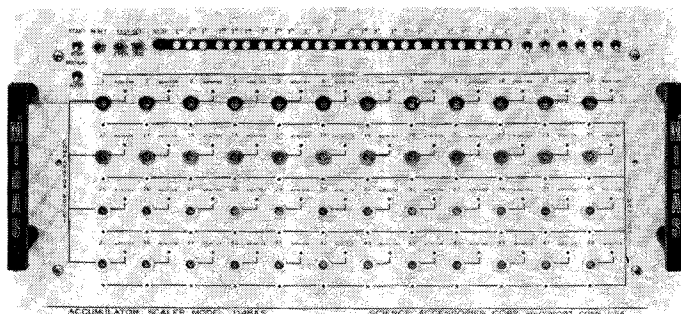


1148 DIGITAL SPARK CHAMBER SCALER UNIT

- Switch select any combination of scalers per unit—2/48, 4/24, 6/16, 8/12
- High adjacent pulse resolution with digital pulse center finder

1148 AS ACCUMULATION SCALER UNIT

- 48, 24 binary bit, 40 MHz scalers-positive and negative input
- Fully computer controllable-random access or sequential readout, individual group start and stop



1100/1200/1300 SERIES DATA ACQUISITION, CONTROL AND READOUT INTERFACE UNITS

- Digital multiplexing, scanning and output device interfaces ranging from typewriters to computers

SAC

SCIENCE ACCESSORIES CORPORATION

65 STATION STREET / SOUTHPORT / CONNECTICUT / 06490 / USA / PHONE 203-255-1526

A SUBSIDIARY OF AMPEREX ELECTRONIC CORPORATION

We've done some deep thinking on detectors



— **25 mm deep, in fact.** We call it the Transverse Field Silicon Detector. It sweeps out in 16nS with 700 volts bias. It has a sub-micron window and is available with areas up to 200 mm². It gives resolutions to 5 Kev FWHM for 970 Kev electrons. It can stop 80 Mev protons, 200 Mev alphas or 10 Mev electrons. The Transverse Field Silicon Detector is in regular production at Simtec Ltd. Write or call for a demonstration and buy yourself some deep satisfaction.

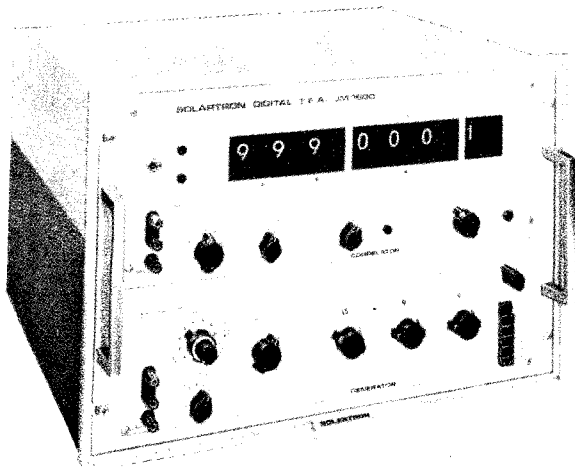
 **simtec ltd.**

3400 Metropolitan Blvd. East, Montreal 38, Canada
Telephone (505) 728-4527

High Energy and Nuclear Equipment S.A., 2, chemin de Tavernay, Grand-Saconnex,
1218 Geneva, Switzerland - Tel. (022) 34 17 07/5
& Castellana Hilton, Madrid - Tel. 257.22.00

Dynamic analysis

0,00001 Hz – 159,9 Hz



- Digital Transfer Function Analyser JM 1600
- Generator : Sine, Square, Triangular
- Modes of Measurement : Cartesian $a + jb$
Polar R, θ
Log Polar Log R, θ
- Outputs : Digital BCD for printers
Analogue for XY plotters
- Remote programming
- Modulator-demodulator JF 1601
(optional extra)

SCHLUMBERGER GENÈVE
INSTRUMENTATION S.A. ZÜRICH

15, rue du Jeu de l'Arc – 1211 Genève 6
Tél. 35 99 50

Manufacturer for the Construction of Electric Furnaces

3, rue des Cras
25 BESANÇON
Tél. (81) 80 36 49
Doubs - FRANCE

Continuous belt conveyor furnaces with controlled atmosphere for hot forming, annealing, brazing, hardening, (bright tempering) carburizing, carbonitriding (air quenched steel and stainless steel).

Modèle pour matriçage avec avance automatique
Modello con avanzamento automatico per stampaggio
Modelo para estancación con antelación automática
Model for stamping with automatic advance
Modell zur Gesenkschmiedung mit automatischen Fließband
תבנית להתקנת אמהות עם קדום אוטומטי
Model dla tłoczenia z automatycznym wysunięciem
Прибор для штамповки с автоматическим выступом

Export to the whole World.
Supplier : Industry, Universities,
Schools, Aeronautic, Aeronautial.

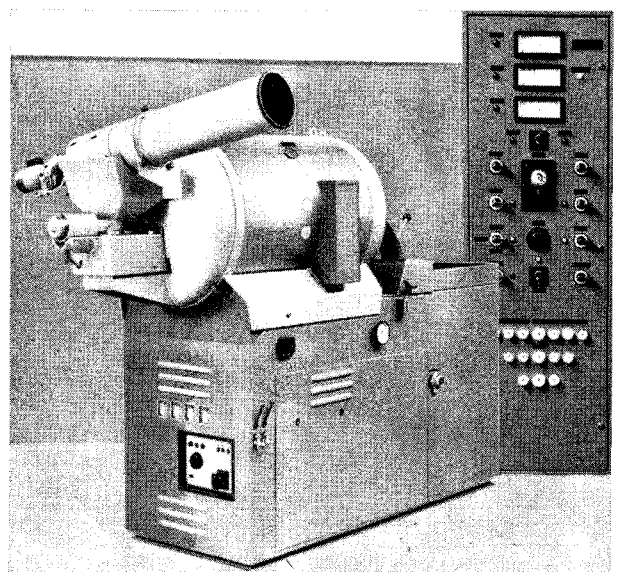
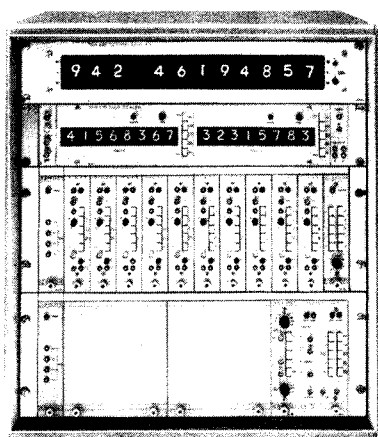


Figure 7

à chaque problème
de comptage...

...une solution spécifique



SYSTÈME 300

Système modulaire universel pour les expériences nucléaires et la physique des hautes énergies.

Gamme étendue d'échelles avec ou sans affichage — 50 et 100 Mhz.

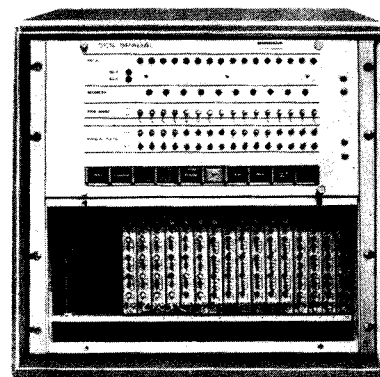
Entièrement réalisé en circuits intégrés ECL et TTL.

SYSTÈME SPADAC

Système d'acquisition de données pour les hodoscopes et les chambres à étincelles et, en général, les expériences nécessitant un grand nombre d'échelles. Destiné essentiellement au couplage en ligne sur ordinateur.

Logique de rejection des événements intéressants. Test automatique de l'ensemble par l'ordinateur.

Entièrement réalisé en circuits intégrés TTL.



pour tous les systèmes...

SEN

ELECTRONIQUE

...vous offre le plus grand choix de moyens d'enregistrement,
de stockage et de transfert des données.

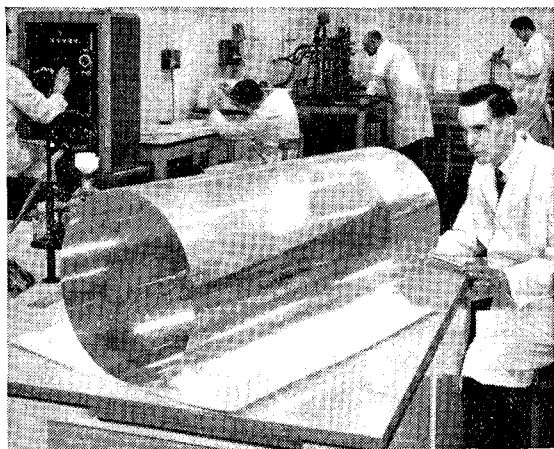
Représentants dans tous les pays.

31, av. Ernest-Pictet
1211 GENEVE 13
Suisse
Tél. (022) 44 29 40

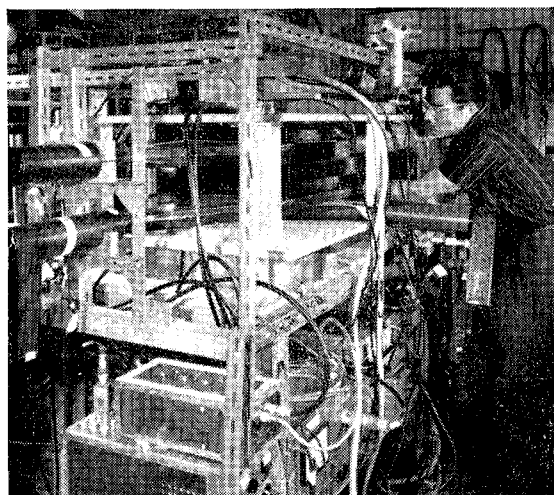
Ferranti Limited
Ferranti Limited
Ferranti Limited
Ferranti Limited
Ferranti Limited

Head Office:
Hollinwood, Lancs.

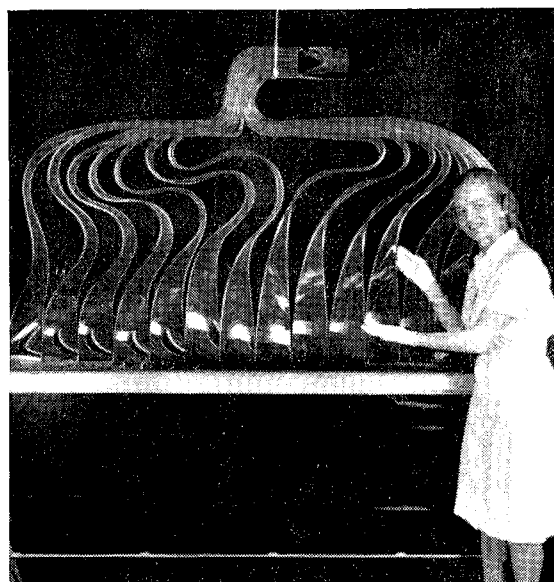
London Office:
Millbank Tower, London S. W. 1.



Plastic scintillator 16 in. diameter by 40 in. length produced for Atomic Energy Commission of Argentine.



Radiation detectors from Nuclear Enterprises being adjusted in the 'Quark'-hunting telescope at the laboratories of the European Organisation for Nuclear Research (CERN) Switzerland. (Photo CERN)



Large adiabatic light pipe coupled to NE 102A sheet 75in. x 24in. x $\frac{1}{4}$ in. (1900 x 610 x 6mm) Produced for Brookhaven National Laboratories.



Which plastic scintillator for your application?

You can select below from the two **best and most widely used general purpose** plastic scintillators known, or the **fastest**; or the **most transparent**. The choice depends on your specific application.

These plastic scintillators are available in all geometries, including **VERY LARGE AREA SHEETS WITH LINEAR DIMENSIONS UP TO 2.25 METRES.**

SCINTILLATOR	Light Output % anthracene	Pulse Width* ns	Decay Time** ns	Light Attenuation Length cm	Max. emission Å
NE 102A: Unequalled allround performance; the world-leader in sales. Hundreds of references in journals attest to this.	65%	3.3	2.5	170	4250
NE 110: The plastic scintillator with the best LIGHT TRANSMISSION especially recommended for large area sheets, large or long scintillators.	58%	3.9	3.3	250	4370
NE 111: Easily the FASTEST of all scintillators; for ultra-fast timing experiments, in sizes up to 5 in. dia. x 4 in. length.	55%	1.54	1.7	8	3700
NE 104: with very short decay time, high light output and moderately good light transmission; for fast timing experiments, no size limitation.	68%	3.0	1.8	100	4050

* Scintillation pulse widths (full widths at half maximum) measured at Manchester University. This is a more meaningful parameter than decay time; reference, paper by J. B. Birks "Energy transfer in organic scintillators", given at Symposium on Nuclear Electronics and Radioprotection, Toulouse, March, 1968.

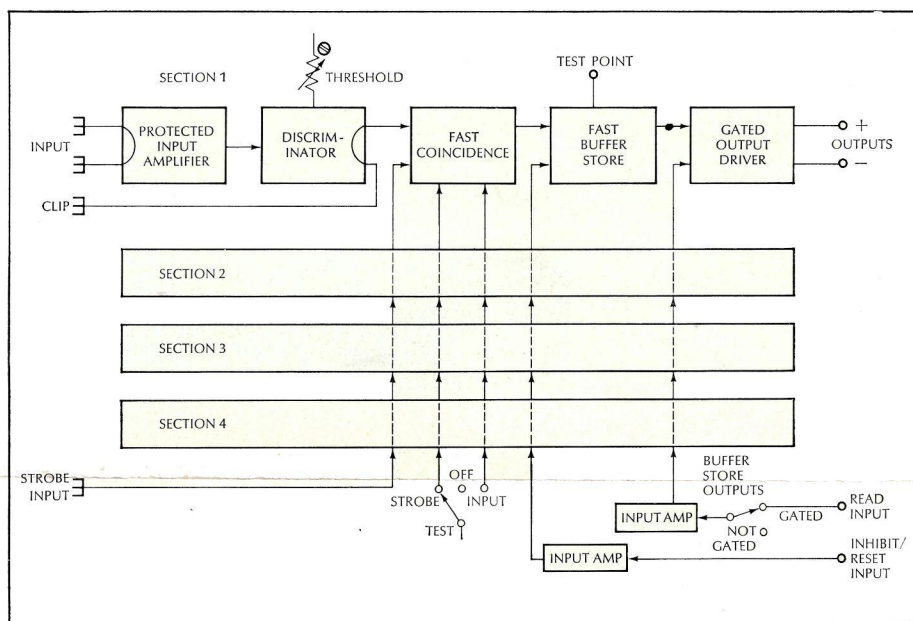
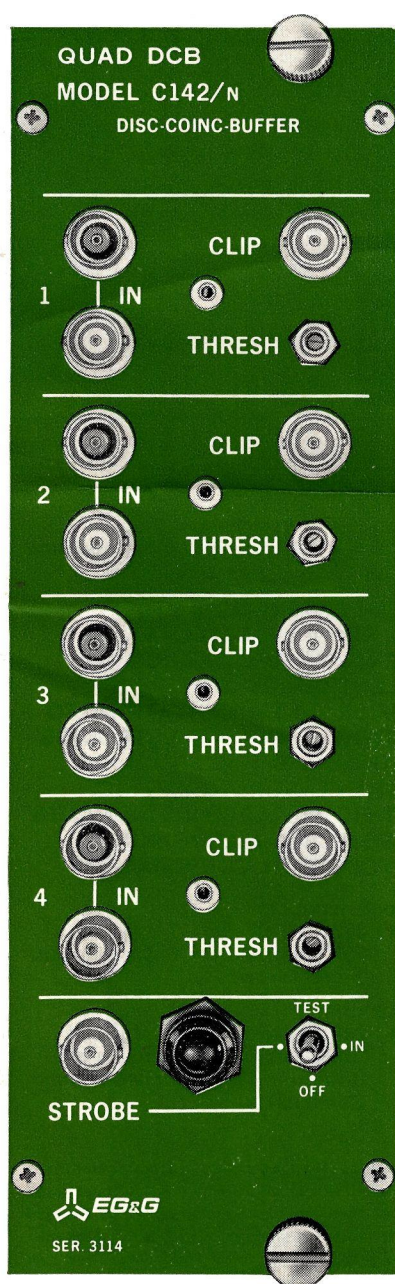
** These are true measured scintillation decay times, and not fluorescence decay times (which are shorter).

Nuclear Enterprises Limited

Sighthill, Edinburgh 11, Scotland. Tel: 031-443 4060. Telex 72333. Cables 'Nuclear' Edinburgh.
Bath Road, Beenham, Reading, Berkshire, England. Tel: Woolhampton 2121.
Telex 84475. Cables 'Devistope', Woolhampton.
Associate Company: Nuclear Enterprises Inc., 935 Terminal Way, San Carlos, California.

Swiss Agents: **HIGH ENERGY AND NUCLEAR EQUIPMENT S.A.**
2, CHEMIN DE TAVERNAY GRAND-SACONNEX
1218 GENEVA
Tel. (022) 34 17 07 / 34 17 05.

How much can you put in a module? Four discriminators...four coincidence circuits...a fast four-bit buffer store...versatile output and control circuitry...almost a bin full of 200 MHz instrumentation is in the new C142/N QUAD DCB...to save you space and money.



How did we do it? We arranged nearly 600 components in four complete data channels, shown above.

"Bridging" inputs to the discriminators are protected to $\pm 200V$ overloads, and allow detector signals to be reused or conveniently monitored. Each discriminator has a multiturn threshold control, -100 mV to at least -500 mV, and each discriminator will operate in excess of 200 MHz. The "biased amplifier" discriminators have no dead-time, and output signal width is equal to input width above threshold. The CLIP connector allows discriminator output signals to be clipped with a shorted stub, without multiple pulsing, to as short as 2.0 nsec.

The STROBE input accepts NIM-standard fast logic signals, and each of the four

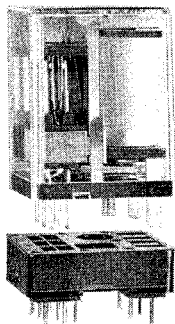
direct-coupled coincidence circuits is capable of 200 MHz operation.

Each coincidence circuit drives a fast buffer store (tunnel diode flip-flop) which is reset and inhibited from the rear-panel interface connector. A rear-panel locking toggle switch allows the buffer store content to be read out upon computer command, or allows the buffer store content to read out directly at all times. The buffer store may be monitored from the front-panel test point.

Independent positive and negative polarity outputs are provided at the interface connector and the read and inhibit/reset lines accept either positive or negative signals, to make the C142/N easy to interface to any computer or slow logic system.

There's a lot more to be said about the C142/N...ask us.

For detailed specifications write or call: EG&G, Inc., Nuclear Instrumentation Division, 40 Congress Street, Salem, Massachusetts 01970. Telephone : (617) 745-3200. Cables : EGGINC-SALEM.



Small-Type Relays Series K40

Low contact resistance and reliable contact making
with twin contacts

Short bounce time

Extremely high life expectancy

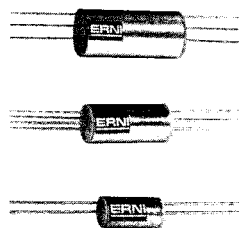
Small dimensions

2 to 6 change-over contacts

Print and solderable types available

Low prices

Various types from stock



Reed-Relays Series M

Miniature and
Micro-Executions

Dimensions:

MINIRID A	Ø 8 × 12 mm
MINIRID B	Ø 8 × 18 mm
MINIRID C	Ø 8 × 23 mm
MICRORID A	Ø 6 × 12 mm
MICRORID B	Ø 6 × 18 mm
MICRORID C	Ø 6 × 23 mm

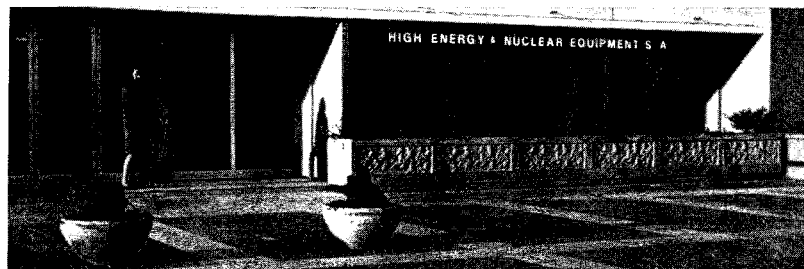
Operating voltage 2 ... 24 V DC

Max. switching	power	28 W
	voltage	500 V
	current	1 A

ERNI + Co. Elektro-Industrie
CH-8306 Brüttisellen-Zürich
Telephon 051 / 93 12 12
Telex 53 699

ERNI

HIGH ENERGY and NUCLEAR EQUIPMENT S.A.



2, chemin de Tavernay, Grand Saconnex, **1218 GENÈVE**
& Castellana Hilton, **MADRID**

For information concerning the equipment available from the Companies
for which we act as exclusive consultant-agent please refer to the full
page advertisement in the October issue of CERN COURIER or ask us
for a copy in English or Spanish.

Technical liaison, supply and maintenance
centre for:

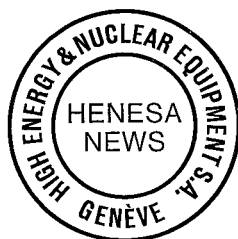
NUCLEAR ENTERPRISES LTD
LABEN, SIMTEC, C.S. ITALIA
20th CENTURY ELECTRONICS LTD
LAN-ELECTRONICS LTD
COMPUTER INSTRUMENTATION LTD
SCIENTIFICA & COOK ELECTRONICS
D.A. PITMAN LTD
JOHNSTON LABORATORIES INC.
SCIENTIFIC RESEARCH INSTRUMENTS
ELECTRONICS & ALLOYS INC.
THE CYCLOTRON CORPORATION

Telephone numbers:

Geneva: 022/34.17.07 /05
Madrid: 257.22.00 (ask for Miss Johnson,
Steno Services)

Telex numbers:

Geneva: 23429 answer back "stiff ch"
Madrid: 27686 answer back "hilma e"
(attention: Miss Johnson Steno
Services)

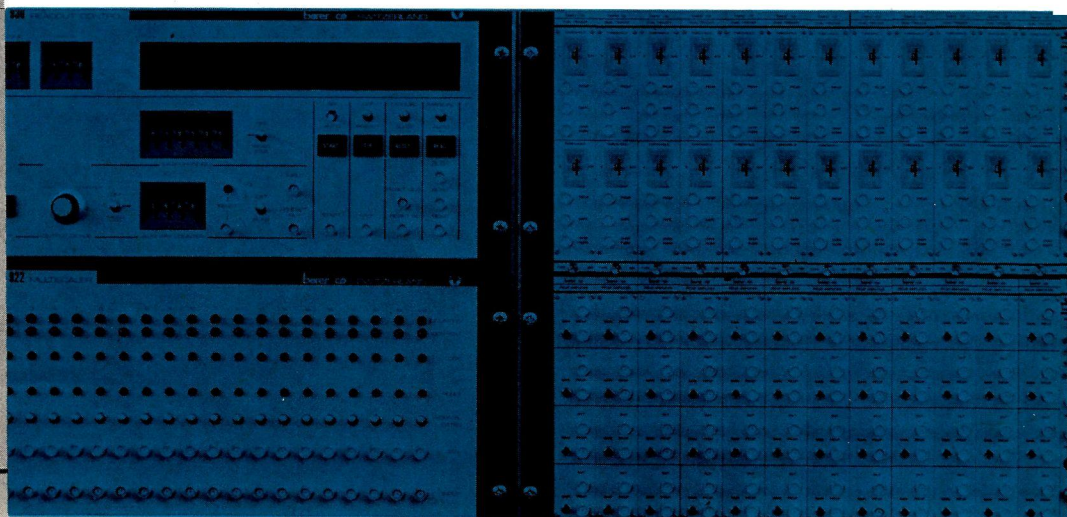
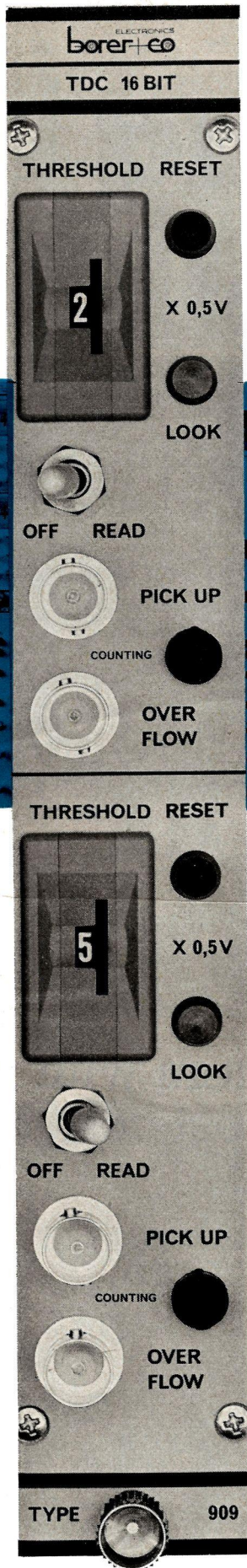


A lot happens in a month! In fact, too much to relate in an advertisement such as this! Example: Nuclear Enterprises have just released and distributed to approximately 20 000 physicists, life scientists and engineers, their 40 page issue of a new Diary of Developments packed with interesting data. If you have not received a copy please ask us to send you one. Another example is the news that SIMTEC can supply 25 mm depth silicon detectors which will «look at» 970 keV electrons with 5 keV resolution, stop 80 MeV protons 200 MeV alphas, and 10 MeV electrons. They can also supply a wide range of low cost planar Ge detectors with specifications matching the best from other sources of supply. If you want to know more, contact us.

We hope you all had a good Christmas and we wish you a happy, healthy & prosperous New Year.

HIDAC means easy and reliable high speed data acquisition!

The HIDAC system applies to spark chambers, hodoscopes, spectrometers and time of flight measurements. It is kept up to date even in some years by the permanent introduction of new modules, which helps to automatise and expand your experiment.



Time to Digital Converter 909

The TDC 909 consists of two independent channels for digitizing the sonic transit time of spark chambers. It consists of a special discriminator input-circuit giving low jitter triggering of the subsequent 16 bit binary scaler, which counts the pulses from a clock-generator with a maximum speed of 20 MHz. The threshold of the input-discriminator is variable from 0,5 to 4,5 Volt in steps of a 0,5 Volt. For multiple-spark-detection with wire-spark-chambers, a special overflow-output is provided, by passing the second and all the following pick-up signals, which can be used to trigger second or further channels. In this way there is no limit to the multiple-spark-detection by switching TDC's in cascade. The double-spark-resolution is 0,5 μ s or 2,5 millimeters for wire-spark-chambers. Using the LOOK-button the contents of this 16 bit binary scaler are displayed on the central control unit in decimal form.

The HIDAC Data Acquisition System is designed for collection of all data in experimental high and low energy nuclear physics. Many special units are available for particular applications, such as recording of data from spark chambers, Hodoscope-arrays, time-of-flight measurements, pulse-height information and counting-rates up to 100 MHz. This equipment was conceived from the many special units over the last few years, together with the latest requirements for ON-LINE control. Our programme does not only consist of a single component for the system, but we have a fully integrated range from spark chambers to interface of computers. We do not claim to have developed this system entirely ourselves, but with the help of our many customers it therefore covers most the requirements in the field.

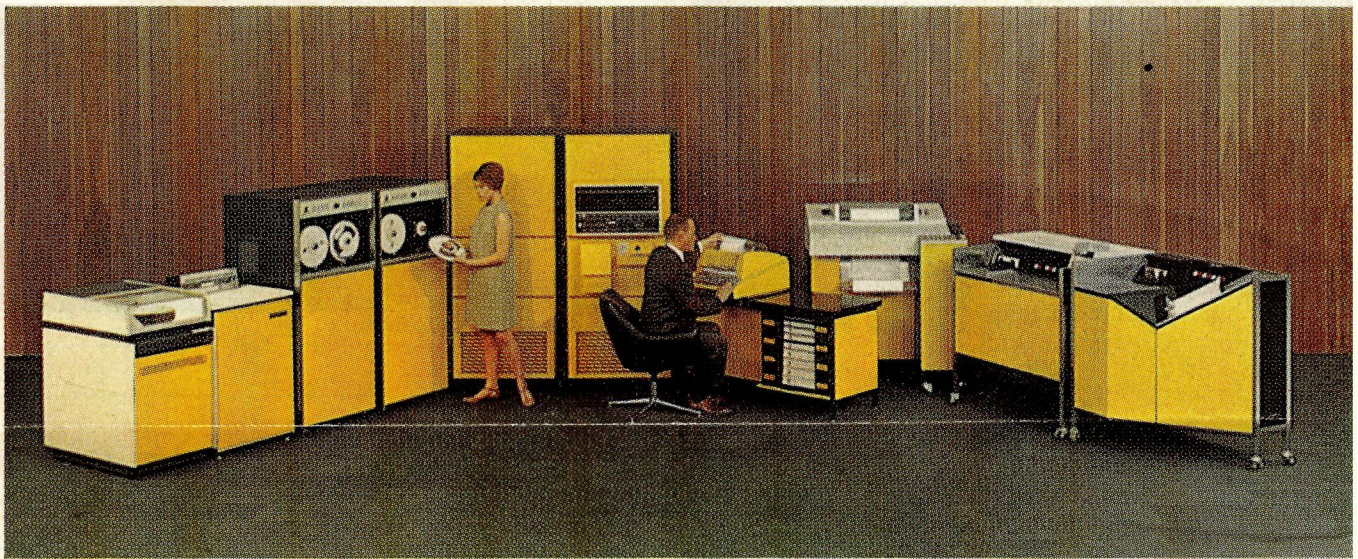
On the left one the modules is introduced.

Great Britain: 36 East Street, Shoreham-by-Sea,
Sussex
Telephone 4305
Germany: Verkaufsbüro München, Kaiserstr. 10,
D-8000 München 23
Telephone 34 80 16
France: Sorelia Electronique, 150 rue de Chatou,
92 Colombes
Telephone 782.16.39-782.32.79

borer+co ELECTRONICS

Switzerland: Heidenhubelstr. 24,
Solothurn
Telephone 065/2 85 45

Introducing Honeywell Series 32



**32-bit real time computer system with
nanosecond speeds and the lowest cost per
instruction in its class**

The announcement of this Series represents Honeywell's entry into the medium-to-large scale scientific computing market. Designed around 'state of the art' components and subsystems, the Series 32 is the most powerful computer system in its class. Series 32 is backed by a library of scientific and real time software routines, total application support and full range of peripherals.

The Series 32 is flexible. You can start small, expand as your requirements grow... from a minimum 8K memory with one central processor and input/output processor to a maximum system with 131,072 words of memory, four central processors and four input/output processors. The Series 32 is applicable in many areas: trainers/simulators, message switching/data retrieval, general purpose

scientific, and physical sciences. The Series 32 has extensive software packages; basic operating system, loaders, macro assembler, fixed and floating point math libraries, extended FORTRAN IV, and many others. For full details please write to Honeywell Controls Limited, Computer Control Division, 73 Route de Lyon, Geneva. Geneva 44 25 50.

Honeywell