

Professor Leprince-Ringuet said that the Scientific Policy Committee considered that it would be catastrophic for the future of CERN if the preparatory studies for the 300 GeV project were stopped. The working group would be broken up; it would be difficult to set up again and the breaking up would give the impression that the project was being abandoned for a fairly long time. This would have irreversible effects in many countries, which would revise the balance between national and international expenditure. The SPC was firmly of the opinion that the preparatory studies should continue.

It was agreed to continue the work for three months on the basis of a budget for 1966 of 4 million Swiss francs while the problem is being reconsidered by the Finance Committee.

Nine Member States offered a total of twenty-two sites for consideration as the location of the 300 GeV project. This has now been reduced to thirteen; Germany and Italy are putting forward more than one site and discussions will be started shortly with the authorities concerned to determine the order of preference. Site studies are now in progress. They include investigation of the site itself — geological, geotechnical and hydro-geological — and also investigation of local industrial potential, manpower availability, housing, etc. Council has requested an interim report on the site proposals at the June 1966 meeting and complete dossiers on the 8 or 10 remaining sites by June 1967. The President reminded the Delegates that a method for selecting the site remains to be established.

In addition to the site studies, preparatory work concerning the machine itself is underway on a small scale. It includes basic design studies for the accelerator. The European Committee on Future Accelerators, which under the Chairmanship of Professor Amaldi recommended the 300 GeV machine in its report of 1963, has been reconvened to discuss the technical and scientific problems connected with the project and to give guidance on the work to be done during preparatory studies.

And then there were thirteen —

The sites remaining under active consideration for the proposed 300 GeV machine are as follows:

Austria	Göpfritz
Belgium	Focant
Federal Republic of Germany	Drensteinfurt
	Ebersberg
	Reimsbach
	Sarrlouis
France	Le Luc
Italy	Doberdo
	Nardo
Norway	Kongsvinger
Spain	El Escorial
Sweden	Uppsala
United Kingdom	Mundford

There are also general layout studies and feasibility studies for accelerator components — linear accelerator improvements, magnet construction problems (experience is being gained from the models for the ISR), r.f. accelerating systems, induced activity and shielding problems, new control methods and survey techniques.

Serpukhov collaboration

Professor Weisskopf reminded the Council that the USSR would soon be completing their 70 GeV accelerator at Serpukhov, which would be for several years the highest energy accelerator in the world. The possibility of CERN collaboration at this research centre was being discussed and proposals as to the way in which co-operation could be achieved have been put forward to the USSR. The Council supported Professor Weisskopf's initiative.

The Session closed, as reported in the January issue of the COURIER (p. 3), with a farewell speech by the President to Professor Weisskopf after five years in office as Director General, and a welcome and an assurance of continued support for Professor Gregory, the new Director General.

CERN News

PS Breakdown

On the night of 8 February, a mechanical accident occurred on the main magnet power supply of the proton-synchrotron. The PS is shut down and the Experimental Planning Group is working out proposals for a new programme to compensate as far as possible for the loss of the experimental time which had been scheduled up to Easter.

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As the protons are accelerated in the synchrotron, they are held in their orbits of constant radius by a rising

magnetic field in the hundred magnets of the synchrotron ring. This rising field is achieved by providing a pulse of power (which can be as high as 34 560 kW) to the magnets. To take such large surges of power direct from the Geneva electricity grid would produce fluctuations in the grid voltage at the repetition frequency of the machine and affect other users on the grid.

A power supply is therefore introduced between the grid and the magnets to smooth out the effect of the machine pulses. It does this by storing mechanical energy, in its rotating components, some of which is converted into electrical energy once every few seconds to pulse the magnets and the loss in energy is made up more gradually from the grid. The

rotor of the power supply motor in fact weighs 5180 kg and revolves at about 3000 rev/min.

The accident occurred when a clamping band, which holds the rotor coils in position, fractured, possibly because of direct mechanical failure or because of a short circuit which caused sufficient local heating to melt the band. Due to the centrifugal force, the ends of the windings splayed out and hit the stator windings. Both sets of windings suffered extensive damage but no harm appears to have been caused to either the rotor or the stator laminations. Complete spare sets of the windings exist and the motor was immediately taken to the manufacturers to be rewound. It is estimated that the repairs will take three months and will cost about 90 000 Swiss francs.

The experimental time up to Easter has been lost. Fortunately however a six week shutdown was scheduled from Easter until 25 May, to install the new slow ejection system in the East Area, for a major rearrangement of beam lines in both the East and the South Area, and for work on the injector, which includes installation of a new ion source and pre-accelerator column and an improved inflector (see page 29). Some of this work has already started and every effort will be made to complete the shutdown by the time that the repaired magnet power supply is back in action.

A contract for a new PS magnet power supply was placed in the week preceeding the accident. It is a larger supply which will make possible a machine repetition rate 2 or 3 times higher than is available with the present supply. This gain in repetition rate is part of the PS improvement programme. A subsidiary reason for ordering the new supply is to have a spare available.

CERN Stamp

On 21 February, the Swiss Postal Authorities (PTT) issued a 50 centime postage stamp in honour of CERN. The stamp is one of a series of three, the others being in honour of the International Union for the Preservation of Nature and its Resources (10 centime) and of the fiftieth anniversary of the Swiss Industrial Fair at Basle (20 centime).

The decision to issue the CERN stamp was taken in 1964 and five Swiss artists, including Marcel Bron from Site and Buildings Division, were selected to produce designs. The artists visited the Laboratory and were told the story of CERN and shown around the site. They each then presented two designs which were judged on 13 May 1965 by a committee under the Chairmanship of Dr. Tuason, Director General of the PTT, which included representatives of the Federal Commission of Fine Arts, the Commission of Applied Arts, and the Union of Swiss Philatelic Societies. Mr. G. H. Hampton, Directorate Member for Administration, Mr. R. Anthoine, Head of Public Information Office and Mr. J. Baudeloque from the CERN Philatelic Committee were present from CERN.

The selected design, by Mr. H. Kümpel from Zürich, shows the flags of the thirteen Member States of CERN superimposed on a bubble chamber photograph. The flags are



A black and white reproduction of the Swiss postage stamp issued in honour of CERN. The issue will continue for one month from 21 February.

arranged to represent roughly the outline of the Swiss border.

On the date of issue of the stamp, the CERN Philatelic Committee organized a distribution of envelopes, illustrated on the same European and nuclear themes, carrying the stamp postmarked at the CERN post-office. Enclosed in each envelope was a leaflet showing an aerial view of the CERN site and giving some information on the European Organization for Nuclear Research. The Philatelic Committee also organized an exhibition of stamps at CERN from 21-28 February. The exhibition, which attracted several groups of philatelists from outside CERN, was in three sections — one devoted to CERN history, from the

collection of Mr. Pen of Chambéry; the second devoted to stamps on the theme of atomic and nuclear physics from the collection of Mr. Gase and the third to the theme of Europe from the collection of Mr. Baudeloque.

For one day each week for the next six months, the normal franking machine in the CERN post-office will not be in use and the CERN stamp will be used instead for mail going outside Switzerland.

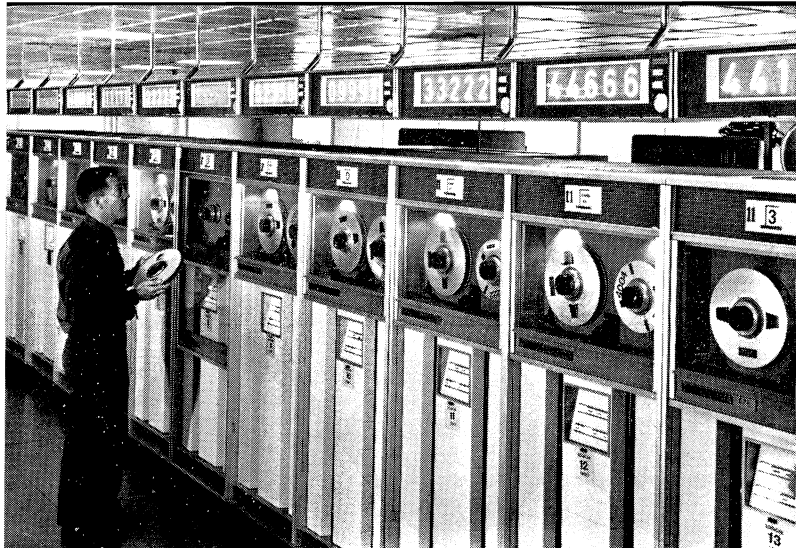
Among the Immortals

On 13 January, Professor Leprince-Ringuet, Chairman of the Scientific Policy Committee, was elected to the Académie Française. Membership of

Professor Leprince-Ringuet (on the right) was elected to the 'Académie Française' in January. He is seen here, in conversation with Professor Perrin (left) and Professor Gentner, both delegates to the December 1965 Council meeting, at the Dinner given by the Council in honour of the departing Director General, Professor Weisskopf.



CERN/PI 186.12.65



The 'tape unit reel number display system' of the 6600 computer, mounted over the tape units. This display system was developed at CERN and installed in October 1965. It serves to inform the operator of the number of the reel required on the unit for processing, by a programme which is executing under the SIPROS operating system.

the Académie is regarded as one of the highest honours in France and the Académiciens are known as 'Les Immortels'. The Académie is limited to 40 members at any one time; Professor Leprince-Ringuet takes the place left vacant on the death of General Weygand.

Louis Leprince-Ringuet was born in 1901 at Alès (Gard). In 1925, he joined the Laboratory of the famous French scientist Maurice de Broglie where he worked on the artificial transmutation of elements, and on neutron and cosmic ray research. He led several research teams in cosmic ray physics and in the 1950s was in charge of a Wilson cloud chamber installation on the Pic de Midi where some of the first studies of the properties of mesons and hyperons were made. (Among the physicists who worked with him during that time were Professor Gregory, now Director General of CERN, and Professor Peyrou, now Head of Track Chambers Division.)

From 1936, Professor Leprince-Ringuet has lectured at the Ecole Polytechnique and in 1949 joined the Académie des Sciences. He was also named Professor of Nuclear Physics

at the Collège de France in 1959 on the death of Professor F. Joliot.

He has been active in the development of CERN since 1952. He was involved particularly in bubble chamber projects, for example, the 1 metre heavy liquid bubble chamber of the Ecole Polytechnique. For the last two years he has been Chairman of the Scientific Policy Committee which makes recommendations to the CERN Council on major items of scientific policy. Professor Leprince-Ringuet spoke on behalf of the SPC, at the December 1965 Council Meeting, on the CERN basic programme, the ISR project and the 300 GeV machine studies (see page 25).

CDC 6600

On 20 and 21 January, the third meeting of users of the CDC 6000 computer series was held at CERN. The meetings are known as VIM meetings (roman numerals, VI = six ; M = thousand). Their purpose is to serve as a forum of 6000 series users which can make collective recommendations to the manufacturer concerning desirable features for the existing computers and concerning future systems. They also serve to bring about some collaboration on programming.

Representatives from the various centres using, or planning to use, computers in the 6000 series attended the meeting. Fifteen CDC 6600's have now been ordered - mainly for centres in the USA but with two 6600s and one 6400 for Europe. CDC are currently working on a 6800 system, which will have a potential speed four times higher than the 6600, and this new computer is expected to be ready around mid-1968.

The CERN CDC 6600 is in operation round the clock, 13 hours being computing time fully absorbed by CERN computing requirements. The rest of the time is divided between system development (5½ hours), engineering (4 hours) and development work for such devices as HPD and Luciole, etc.

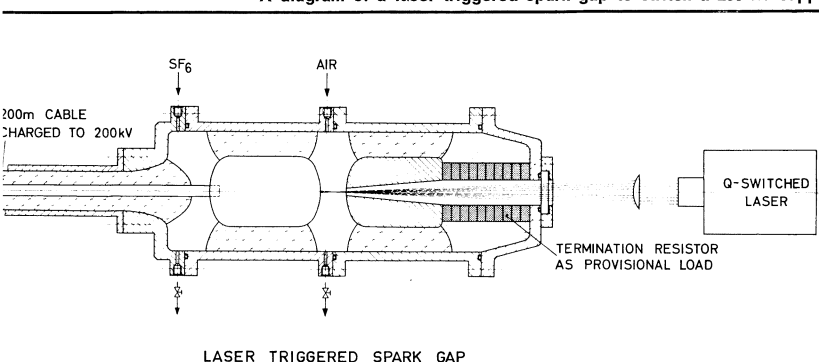
The time-sharing system, SIPROS, is a monitoring program which supervises the progress of the work fed to the computer, organizing the sequence of operation so that use is made of the computer's multi-processing capabilities. It enables many programs to pass through the computer at the same time instead of being run one after the other as at present. A version of SIPROS developed at CERN is now undergoing production testing in order to prove it for full scale operation.

Attempts are being made to establish a thorough system of checks as a permanent feature of the maintenance procedures to prevent a recurrence of the troubles which put the computer out of action in November 1965. As a result of the overhaul done at that time the computer hardware (the central processor, the memory, the peripheral processor, the data channels, etc.) is now working considerably better. Also at that time, a CDC 3400 computer was brought to CERN to provide some on-site computing facilities while the 6600 received attention. It is still being used and will probably stay at CERN until the time-sharing system is in full and reliable operation on the big computer.

Lasers at CERN

It has been known for some time that it should be possible to trigger high voltage spark gaps by means of laser beams. Experiments at CERN and elsewhere have confirmed this, and lasers are likely to be widely used for this purpose in the future.

A diagram of a laser triggered spark gap to switch a 200 kV supply.



A conventional method of switching-on high voltage equipment for a short pulse is by means of a three electrode spark gap. One electrode is triggered to cause ionisation in the gap, which then fires between the other two electrodes to convey the required high voltage to the component concerned. This three electrode device is relatively complicated and presents more and more difficulties the higher the working voltage, as the trigger circuit itself is on a high voltage level. These difficulties are completely removed if the intense beam of light from a laser is used to cause the ionisation in the gap. The trigger circuit is then completely isolated from the high voltage components.

The photograph at the top of page 29, shows a laser being used with a 600 kV pulse generator which is under construction for the study of pulsed separators. These separators may turn out to be of interest for some special beams of short lived particles.

A laser spark gap is also under consideration for switching of a 200 kV supply to a kicker magnet on the PS, which is a component in the system for fast ejection of one or more proton bunches from the synchrotron. The particular requirements of this switching process are that it should have low 'jitter' and be capable of high repetition rates. A research contract was placed in January to investigate the extent to which a laser triggered system will meet these requirements. If it proves possible to use the laser system it will have important advantages such as basic simplicity, even for simultaneous switching of several gaps, improved synchronisation and greater reliability.

Multi-turn injection

At the end of December 1965, multi-turn injection was achieved for the first time on the PS. Injection was continued for three turns with a beam pulse 20 μ s long from the injector. The increase in PS intensity was about 25 %, so that the year ended with a flourish of 10^{12} particles per pulse which had eluded the machine since the July shutdown. Multi-turn injection will now be in regular use.

Although the 500 keV preaccelerator and the 50 MeV linac are usually considered together as the injector of the PS, the term 'injection' applies specifically to the process of feeding the 50 MeV protons into the magnet ring. This has been done by providing a pulse of particles just under 7 μ s

long from the injector; the particles are bent into their orbit in the ring by an electrostatic inflector. Injection continues until the first injected particles have travelled once round the ring and reach the inflector again. Thus the PS is filled with particles for one turn and the process is called single-turn injection.

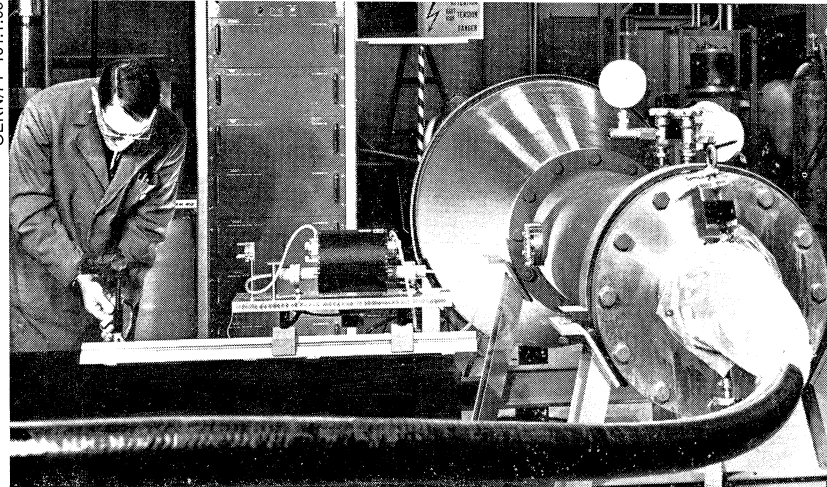
To increase the PS intensity, efforts have previously been concentrated on increasing the number of protons in the one injected turn. While waiting for significant advances to be made here, attention has turned towards 'multi-turn' injection. Injection for three turns requires a pulse 20 μ s long from the injector which involves a longer pulse from the proton source and introduces serious 'beam loading' problems in the preaccelerator and, especially, the linac. An intense particle beam causes an important load on the stored energy of the accelerating field and causes voltages to drop; this is aggravated by lengthening the beam pulse.

Also, the injection process itself of more than one turn is complicated. The protons of the first injected turn, after being bent by the electrostatic inflector, in straight section 26, and the kicker magnet, in straight section 30, will travel on their orbits dictated by the energy of the protons and the strength of the magnetic field. However they do not travel exactly on a

circle (the ideal 'closed orbit') but oscillate about it (betatron oscillations). When the second and subsequent turns are injected, unless something special is done, the newly introduced protons and those already circulating will approach the kicker magnet in very different directions. The deflection introduced at the magnet would then cause one or other group of protons (depending upon whether the magnet was left on or switched off) to be bent so that they would hit the walls of the vacuum chamber and be lost.

To prevent this and to ensure that virtually all the particles lie within what is known as the 'acceptance' of the PS, the closed orbit is locally distorted near the inflector (see figure) so that the orbiting protons and the newly injected protons approach the kicker magnet from roughly the same direction (the turns separated by only the thickness of the lip of the inflector or 'septum'). The local distortion is introduced by an additional kicker magnet in straight section 22 and the kicker magnet in straight section 30 (half a betatron wavelength away) cancels the distortion.

The problems were gradually overcome during the past year. Further improvements to the linac beam and a new inflector tank are planned for 1966, and should result in still better exploitation of multi-turn injection.



The use of a laser to trigger a 600 kV supply for the study of pulsed separators. A continuous 600 kV generator is connected to a heavy screened cable (running along the bottom of the photograph) and discharged through a spark gap, triggered by a short pulse from a laser beam. The laser (centre of photograph) is being aligned with the window of the spark gap chamber.

A schematic diagram of the multi-turn injection process.

