

The on-line isotope separator from Orsay installed in the neutrino tunnel at the CERN PS. The proton beam, which produces the nuclides of interest by bombarding a target of heavy nuclei such as uranium, enters from top left. The on-line mass spectrometer goes off towards top right. Five new isotopes of sodium were studied in the course of this experiment.

boron could be the result of the spallation (when a number of light fragments break off a nucleus leaving a lighter nucleus) of carbon, oxygen and nitrogen in the stellar atmosphere. The same reactions in interstellar gas could explain the very high abundances of lithium, beryllium and boron in cosmic rays.

Thus it become important to know the cross-sections for the production of the long-lived isotopes of lithium, beryllium and boron from carbon, oxygen and nitrogen. One intriguing possibility is to have an estimate of the distance travelled by cosmic rays before they reach the earth. If the production theory is correct and if the cross-sections are known at cosmic rays energies, then the observed abundances at the earth give a figure for the amount of interstellar gas traversed by the cosmic rays. This is a particularly interesting figure now that the source of cosmic rays is becoming widely accepted as the pulsars.

Taking oxygen as a representative nucleus, very pure samples of water were irradiated at energies from 155 MeV at

Orsay, to 600 MeV and 19 GeV at CERN. (The cross-sections do not vary very much with energy.) These samples were then examined in a special mass spectrometer designed and installed at Orsay. In this spectrometer a beam of singly charged cesium ions impinges at 45° on the sample and liberates singly charged ions of lithium, beryllium and boron from atoms produced during the previous irradiations of the oxygen. Minute quantities of these ions can be observed. The technique gives the ratios of these ions and absolute values are then found by reference to the radiochemically determined ^7Be cross-section. In this way values for the production cross-section of ^6Li , ^7Li , ^7Be , ^9Be , ^{10}Be , ^{10}B and ^{11}B have been determined.

The results have been influential in many theories in cosmic ray physics and astrophysics. For example, the calculation of the quantity of matter traversed by galactic cosmic rays of energies greater than 1.5 GeV/nucleon gives a figure of 5.4 g/cm^2 which is higher than the previously accepted value of 3 g/cm^2 .

CERN News

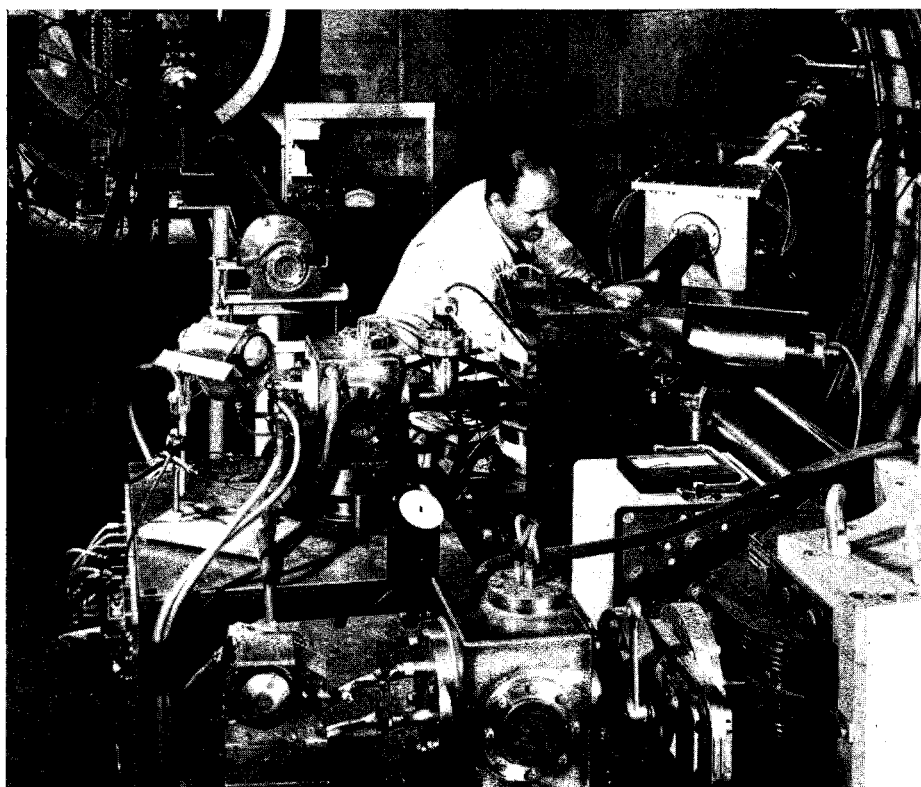
3 MeV first beams

The 3 MeV experimental linac accelerated its first proton beams on 18 November. It will now be launched on a series of investigations of beam behaviour at low energies in a linac structure.

As mentioned in the article in the last issue of CERN COURIER on the ten years operation of the linac of the 28 GeV proton synchrotron, effort is going into trying to acquire a thorough understanding of how linacs actually work as opposed to how they are supposed to work. The 'simple' theory of linacs has been successful in producing beams to meet most requirements until recent years. But now, with the imminent demand for higher quality beams, it is important to have much more detailed knowledge of how accelerator components behave in order to push their performance to near the optimum.

On the PS linac, for example, despite the achievement of 50 MeV beams well in excess of 100 mA, there are many phenomena which are not well understood. The beam appears to be reaching space charge limits, brilliance limits ('brilliance' being a measure of beam quality concerning the number of protons which can be packed into the beam with the right parameters to take them through the linac) and appears to suffer some sort of transfer between its transverse and longitudinal properties. With the PS obviously in use as much as possible for high energy physics experiments, it is difficult to find time for a thorough analysis of these phenomena. Also the PS linac is, in its design, not well adapted to the type of detailed measurements such as would make the analysis easier.

Most of the trouble seems to arise at the low energy end of the linac and since there already existed at CERN an ion source and pre-accelerator test station, it was decided to add a low-energy experimental linac (taking beams from 0.5 to 3 MeV) to study beam behaviour under high current density conditions. The drift tube geometry of the 10 MeV first tank of the PS linac was used but the experimental linac was built of copper-clad steel rather than using a copper tank inside a



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steel vacuum envelope. It was constructed to give easy access, and better and stable alignment of the drift tubes. The vacuum system, using turbomolecular and ion pumps and metal seals, restores operating conditions very quickly after the linac has been opened up. The linac is surrounded by a battery of conventional diagnostic equipment.

Experiments with the 3 MeV linac will measure beam parameters such as accelerated beam current, beam emittance, energy and energy spread, phase and phase spread, and will study their variations in a variety of operating conditions. The more detailed knowledge that this will bring should benefit both present and future accelerator projects.

Use of a 'miniscanner'

When the accelerated protons are being ejected from the PS using slow ejection, the beam is made to travel outwards radially in a spiral. For the particles to be ejected, the pitch of the spiral increases exponentially and, when it is of the order of 20 mm, they can 'jump' the width of the septum of the ejection magnet, which will then steer them out of the machine. This 'jump' takes the protons from one side of the septum to the other on successive turns and has to be at least equivalent to the thickness of the septum in order to reduce to the minimum the number of particles lost by striking the septum.

Until recently, a squared screen arranged perpendicularly to the beam was used to observe the position of the beam on successive turns. The luminous spot produced on the screen by the beam was viewed by a closed circuit television camera. However, the information obtained in this way did not always show with sufficient precision the radial distribution of the particles in the beams, and this knowledge is essential for fine adjustment of the slow ejection system.

A detector referred to as the 'miniscanner' was therefore developed. It consists of a probe, in the shape of a small flag, which can be moved radially to stop at regular intervals, and which scans the cross-section of the beams in front of the ejection magnet. The probe is connected to a system for measuring the

charge induced in it by the beam particles; the charge is proportional to the beam density.

The movements of the probe, which can be tracked to an accuracy of ± 0.075 mm, are controlled by the IBM 1800 control computer in the PS control room, which also receives the information from the miniscanner and is thus able to plot the radial distribution curve directly. One series of measurements, generally corresponding to twenty-five positions of the probe, takes about twenty minutes. The fluorescent screen system, fitted on the same mechanism, is still used for quick overall checks.

The first tests with the miniscanner showed that measurements could be falsified due to the ionization of the residual gas in the vacuum chamber by the proton beams and by the presence of variable electric and magnetic fields. This has been overcome entirely satisfactorily by surrounding the flag with a copper sleeve maintained in position by alumina 'pips' and held at a positive potential of 50 V. This electric field eliminates the

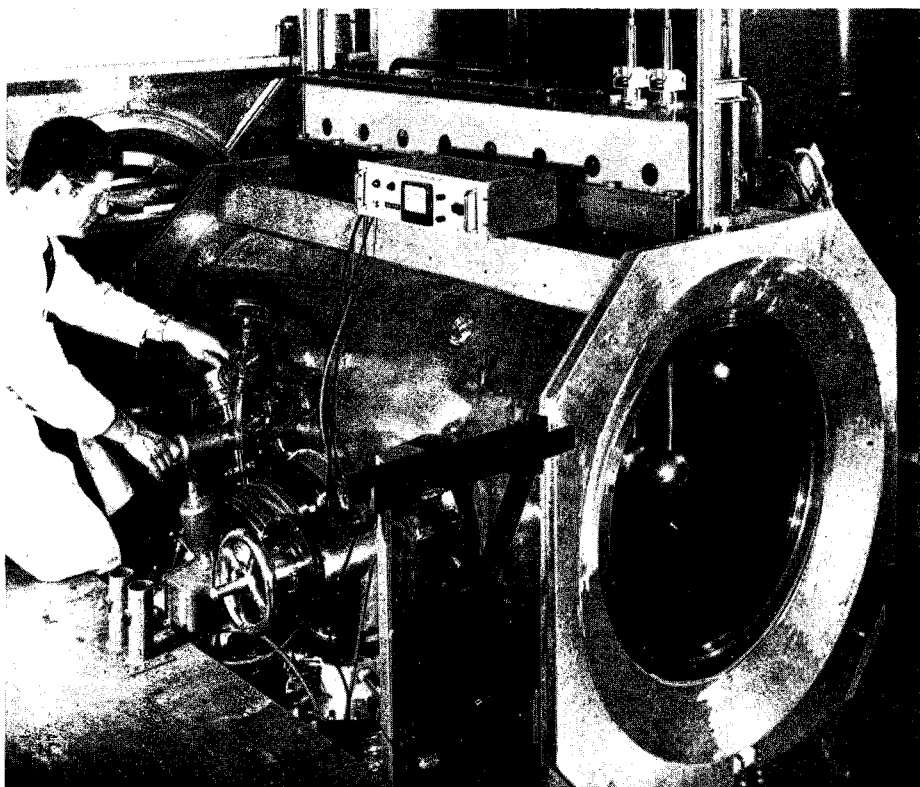
effects of the surrounding variable electric and magnetic fields, and also protects the probe from the positive ions.

Three miniscanners are currently in use on the PS — one for ejection 58, one for ejection 62 and one in straight section 63, upstream of ejection 62. It is intended to use other devices of the same type for ejection 16 which will send beams to the ISR and, later, for the measurement of spatial densities (both vertical and horizontal) of one of the slow-ejected beams.

New CERN Restaurant

At its one hundredth meeting, held on 12 November, the Finance Committee approved the award of the contract for the civil engineering work of the new CERN restaurant to the firm Reaktorbauforschung und Baugesellschaft (RFD), Austria, for a sum of 1 654 000 Swiss francs.

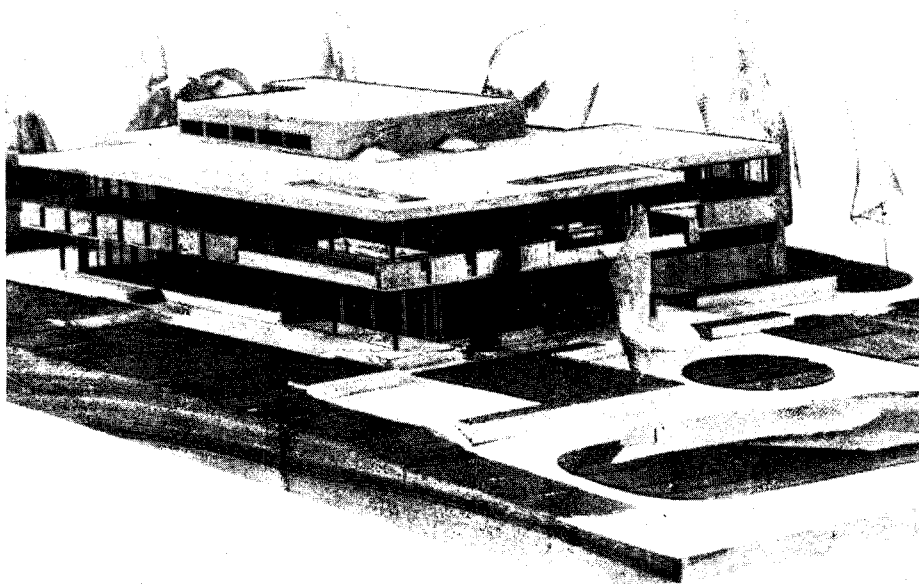
Construction is scheduled to begin on 1 March 1970 and to finish at the end of the same year. The restaurant should be in use by about October 1971, at a time when several new buildings will be occupied on the site of the Intersecting



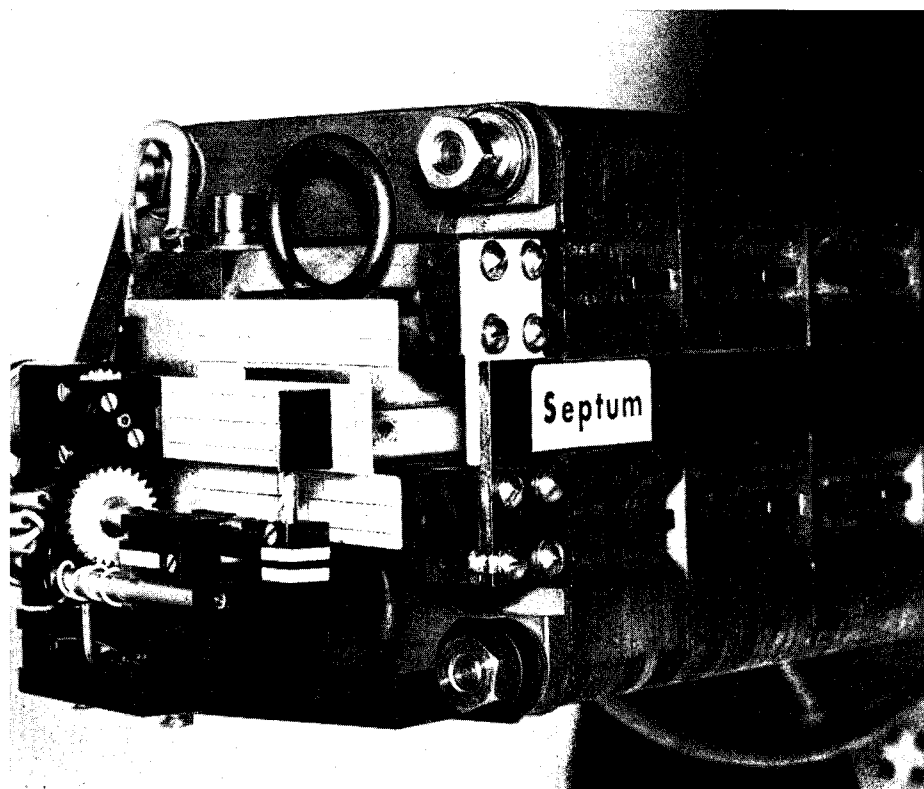
CERN/PI 241.2.69

A model of the new CERN restaurant to be built behind Mont Citron, near the Franco-Swiss border running across the site. It is scheduled to come into service before the end of 1971. Its seating capacity will be the same as that of the present restaurant in the Main Building, and it will also house a library, a discothèque and a games room.

The 'miniscanner' in position in front of the ejection 58 septum magnet. The mechanism provides for the movement of a probe, in the shape of a flag, across the proton beam to allow the spatial density of the beam to be accurately measured. The squared screen rapidly provides more general information about the radial position of the beam.



CERN/PI 200.9.69



CERN/PI 18.9.69

Storage Rings. The restaurant will thus meet a growing need.

The main purpose is to provide a restaurant equipped to serve 1000 midday meals, but the whole complex is designed to be a centre where people can relax. There will be a cafeteria adjoining the restaurant, a library, a discothèque, a games room, a newspaper kiosk, a bank, telephone booths and even a 'Bancomat' (distributing bank notes to people who possess a special magnetic card). A post office may also be installed.

In order to simplify the problem of customs concessions for products consumed in the restaurant, it will be built on a plot of land in Switzerland (surface area around 6500 m²) recently acquired by CERN. It borders on French territory adjoining the Mont Citron car park.

The terraces and bays of the building will open to the South-East and the South-West and will overlook the peaceful landscape of the Satigny and Bourdigny vineyards. The calm atmosphere will be reinforced by excluding cars from around the building.

Plans for the building were drawn up by the Geneva architect Ernest Martin et ses Associés in close collaboration with the SB division. It will be on two levels with a smaller area, the entresol, between. The restaurant on the first level will seat 400 (about the same number as the present restaurant in the Main Building). There will be two counters with a serving system similar to the one in the Tortella restaurant. The service should be faster because payment will be made on leaving the restaurant and not at the end of the queue for meals.

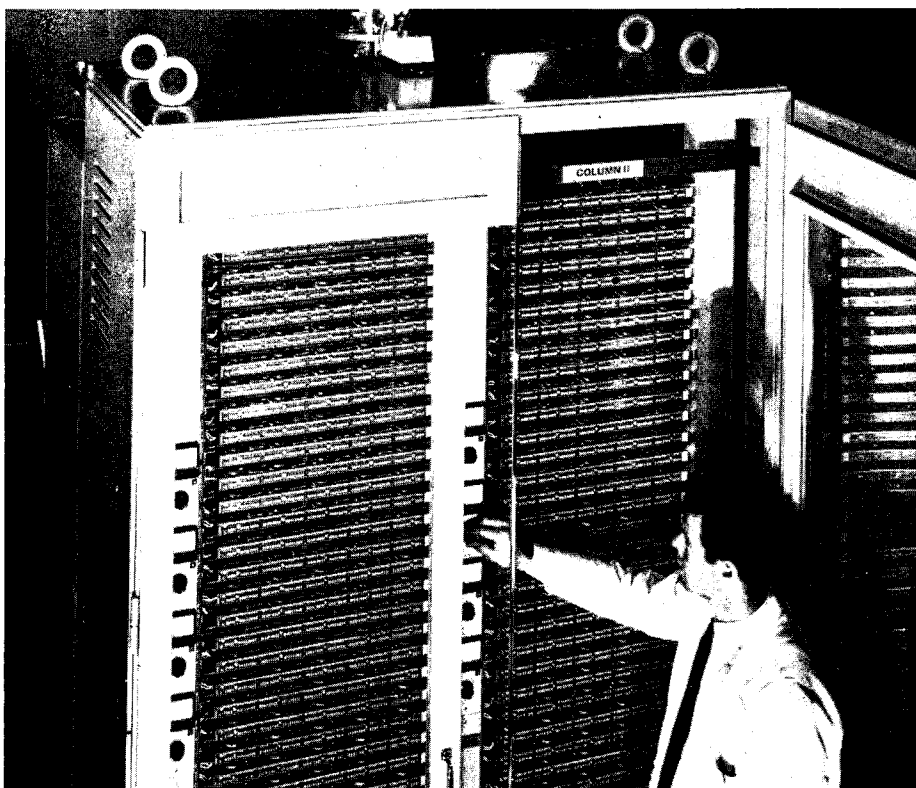
There will be terraces on two sides of the restaurant with seats for 200, where people can eat their lunch when the weather is fine.

The cafeteria on the ground floor includes a bar and will have about the same capacity as the one in the Main Building (including its recent extension). The entresol will house the games room placed at the disposal of the Staff Association and will remain open even when the restaurant is closed.

The restaurant could be extended at a later date to increase its seating capacity by 30 % to 40 %.

A large transistor bank, shown in the photograph, to give a nominal current of 13 000 A has been designed at CERN and built by J. Alge (Apparatebau, Austria). It is to be used as the control element of a pulsed power supply (100 V, 13 000 A) for the flat-top current in septum ejection magnets. One of its main advantages is that it enables the current to be held stable within the order of 10^{-4} of the nominal value (an improvement of a factor of about ten on the previous power supply).

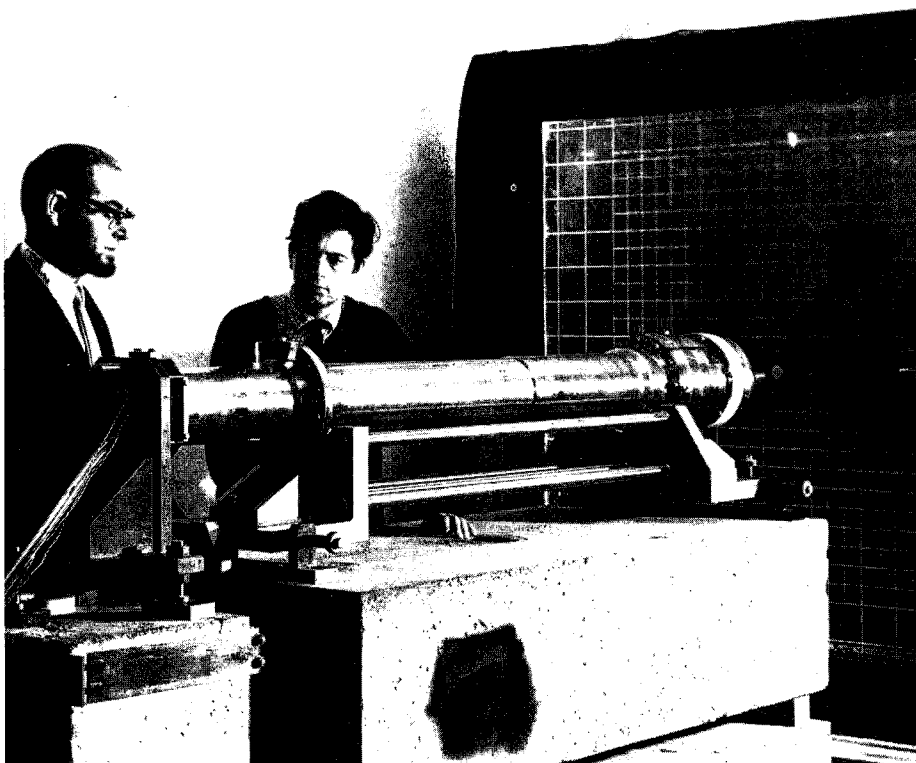
The transistor bank consists of 7580 transistors in a three stage Darlington circuit. The transistors are mounted on water-cooled modules which are stacked in a self-contained cubicle with all electrical and water connections at the rear and with simple arrangements for checking of individual components. Development of the transistor bank, including an extensive test programme to ensure long-term reliability was carried out in the PS Division by F.F. Depping. The new power supply is scheduled to come into operation on the proton synchrotron at the beginning of 1970.



CERN/PI 353.10.69

With a bubble chamber such as Gargamelle, which has a volume of several cubic meters, major errors are liable to occur because of optical distortion in the lenses. In the worst conditions these errors may be as great as 3 cm. It is therefore essential to know the extent of distortion exactly in order to be able to correct for it when processing the data. The eight lenses of Gargamelle are being calibrated at CERN — work began in August 1969 and should finish by February 1970. The lenses were made by Sopelem (France) and cost nearly 80 000 Swiss francs each.

The measurement procedure is to fix a squared panel perpendicular to the axis of the lens, and to photograph this on a film which is then scanned. The position of the lines on the panel (to a precision of 0.01 mm) and the measurement precision of the film (± 3 microns) are known. Measurements are taken at 1000 points for two different positions of the plate. The results are punched on to cards and processed by the CDC 6600.



CERN/PI 261.11.69

1. Saturday 25 October was 'Open Day' at CERN when CERN staff, their families and friends could tour the site to see the big machines and specially prepared exhibits illustrating the work of the different sections. By the end of the day 2472 visitors had been clocked through the gates.

For the first time on an Open Day, there was much to see at the Intersecting Storage Rings and the photograph shows visitors flowing through the huge tunnel where many magnet units are now installed.



CERN/PI 562.10.69

1.

2. From 3-7 November a group of British companies organized an exhibition of electronic, electrical and engineering equipment at CERN under the auspices of the trade association BEAMA. The companies represented were Airflow Developments, Alma Components, Arco Electric, Drallim Industries, Edwards Vacuum Components, Electrosil, EMI Valve Division, English Electric Valve Company, J. and P. Engineering, North Bridge Engineering Co., Nuclear Enterprises, G.D. Peters and Co., Vera Electronics, and Westinghouse Brake and Signal Co.

On 5 November the British Ambassador, Mr. H. Hohler visited the exhibition and is seen, second from the left in the photograph, at the English Electric stand holding a fibre optic tube used for low light television.



2.

3. A celebration was held in Experimental Hall 14 of the Intersecting Storage Rings on 7 November to mark the 'closing' of the ring tunnel to house the ISR. Work on the site began almost exactly three years ago, involving the excavation of over a million cubic metres of soil, and in October 1967 construction of the tunnel itself started. Now the full circumference of almost one kilometre has been completed.

The main contractor for this construction has been the firm Sogene of Italy with the firm Albanese, also of Italy, as subcontractor for the excavation. The photograph shows a group of contractors' staff celebrating the end of the major part of their work.



CERN/PI 111.11.69

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4. The Finance Committee in session on the 12 November, its one hundredth meeting since the beginning of CERN.

The Finance Committee is an advisory committee to the CERN Council regarding CERN's financial policy. It has the exacting job of supervising CERN's finances being concerned with such things as examining budget proposals, salary structures and cost variation formulae and with approving the award of major contracts placed with industry. It exists to keep CERN on its toes in matters of finance. But CERN owes a lot to the constructive way in which the Finance Committee has always carried out its role and to the devotion to the aims of CERN which has guided its decisions.



CERN/PI 179.11.69

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