

Tracks in BEBC

During the night of 3-4 March, the first photographs of charged particle tracks were taken in the 3.7 m European bubble chamber, BEBC. At the time of writing, tests are continuing but all the major components have already been taken through their paces very successfully. Work has started on optimizing chamber performance and photograph quality.

The present series of tests began mid-January with the cool-down of the huge superconducting magnet. The chamber was not at that time filled with hydrogen so that the operators could master one system at a time. The cool-down was done slowly over nine days to avoid thermal stresses which could damage the magnet cryostats. The helium refrigerator, where trouble had been experienced earlier, worked well. The cryostats were filled with 20 000 l of

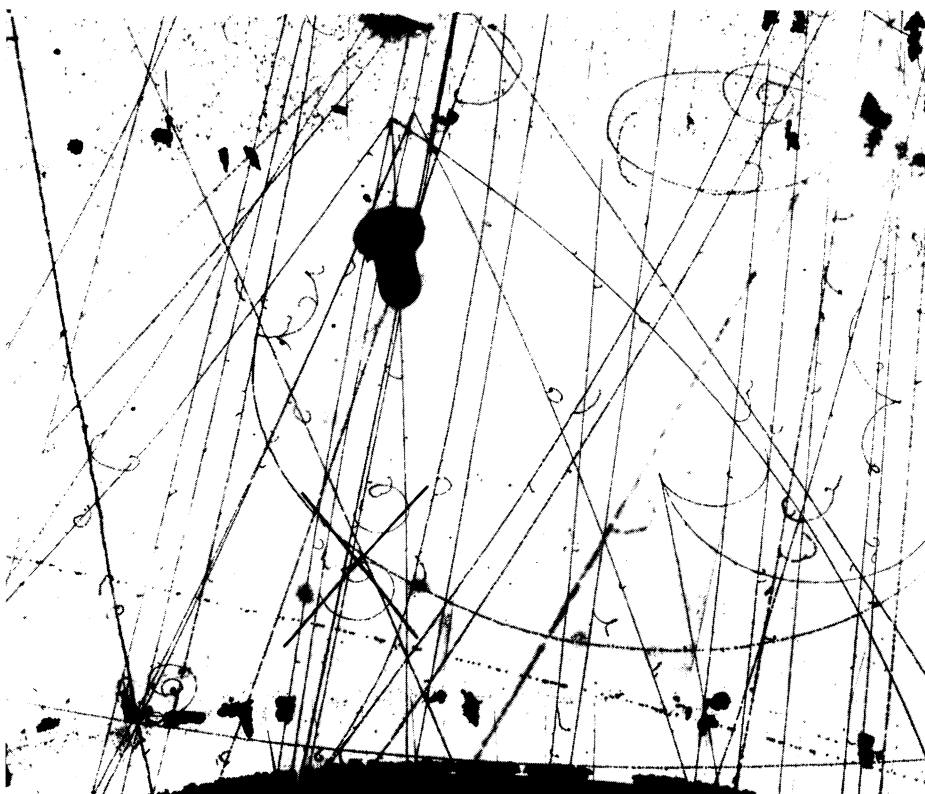
liquid helium and, when operating temperatures were reached, current was fed to the superconductor increasing in steps towards the design level. This enabled safety devices and instrumentation to be checked progressively. The optical and expansion systems were also operated so as to detect any effects due to the fringe field of the magnet. Small effects were noticed as peak field was approached but they can be cured fairly straightforwardly by extra magnetic shielding.

On 24 February, the current fed to the coils reached 5 kA and the magnetic field in the useful volume of the chamber climbed to 3.1 T. This current corresponds to 550 MJ of stored energy. A map of the field was taken (as at each current level on the way up) using 180 Hall probes linked to a computer. These give a relative precision of 0.05 %; absolute calibration using a nuclear magnet resonance probe will be done later. The effect of

frozen flux fields (the superconductor is not of the 'intrinsically stable' type) was observed but the magnet has not yet been powered for long enough at one stretch to measure their long term effects.

Helium was then drained from the magnet cryostats (but the magnet was kept cold) while attention switched to filling the chamber with hydrogen. The chamber was cooled in three days and, on 3 March, 38 000 l of hydrogen were pumped in without problem. Expansion tests began and as soon as sensitive conditions (correct temperature, pressure and piston stroke) were established, tracks were photographed. A beam of particles was available from the proton synchrotron — not yet a tidy beam but adequate to make the observation of tracks possible. The track quality was good from the beginning and distortions due to turbulence were quickly eliminated.

Charged particle tracks recorded for the first time in the 3.7 m European bubble chamber, BEBC, at the beginning of March. In this photograph of part of the chamber volume a beam of positive particles of energy about 6 GeV arrives from the top and several interactions can be seen. Note that the chamber uses bright field illumination, the walls being lined with Scotchlite. With a large chamber volume, cosmic ray particles are also likely to be recorded. The heavy track on the left and the track of low bubble density crossing the photograph are cosmic rays passing through the chamber not synchronized with the operation of the pressure system. The central black mark is a vapour pressure monitor and other marks are from boiling at seams on the Scotchlite which will be cured.



The huge assembly hall at Laboratory II which has a floor area of about 11 000 m². The hall was brought into use in February when the prototype magnets were wheeled in. Some Lab. II staff have moved over from their temporary accommodation in Lab. I to the first office block to be completed, which is alongside the assembly hall.

During this time the magnet, cooled with helium gas, was fed with low current (1kA corresponding to 0.6 T in the chamber) so as to have some magnetic force pulling the two coils together. This avoids possible damage by preventing them from bouncing around when the expansion operates. Some curvature of the tracks was thus achieved as a by-product.

The remaining step in the tests is to operate the chamber in the highest possible magnetic field. This might however be postponed until the next run, because there is trouble with a hydrogen leak.

Mole in the hole

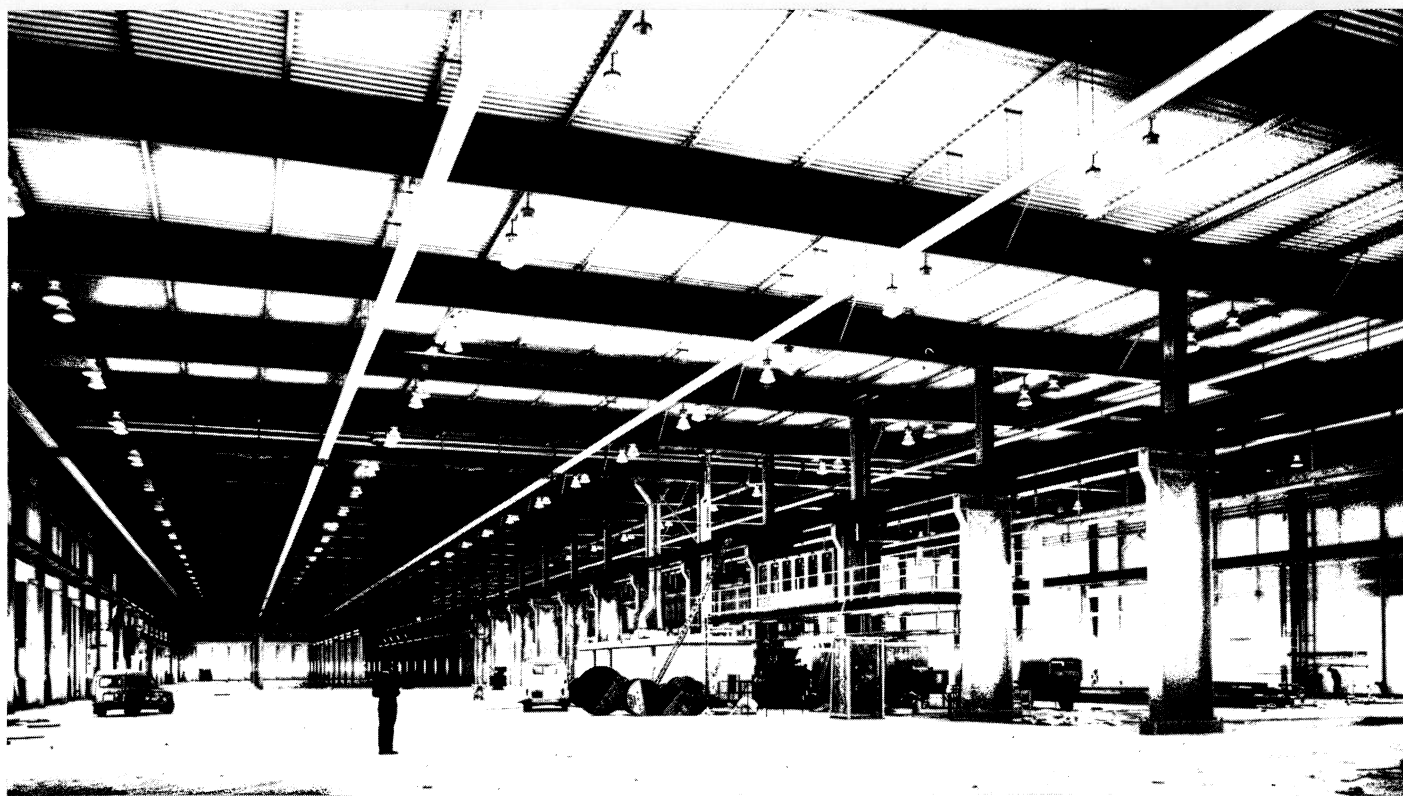
February 19 was the second anniversary of the authorization of construction of the SPS by the CERN Member States. The anniversary was celebrated by a start on boring of the ring tunnel by the 'mole'.

The tunnel for the new proton synchrotron will be 4.8 m in diameter with a circumference 6.9 km and its average depth will be 40 m below ground. Boring this tunnel is probably the most impressive part of the civil engineering programme of Laboratory II.

Among the reasons for selecting a tunnelling scheme (rather than 'cut and fill') was a desire to avoid changing the character of the countryside in a major way so that agricultural and forestry activities can continue much as previously. A second reason is the variation in altitude over the site (45 m between the lowest and highest points) which would have made 'cut and fill' very difficult. To retain a minimum earth shield of 20 m for radiation protection, the tunnel will be bored at a depth which is 65 m below the highest point on the surface. A final point is that the molasse bedrock is solid enough to allow the tunnel to be bored reasonably easily.

A detailed description of the boring machine, known as the mole, can be found in vol. 12 page 124. The machine is a conventional Robbins boring machine built for CERN in a factory in Seattle, where it underwent pre-delivery tests. It came by sea from the Pacific coast of the USA through the Panama Canal to Rotterdam and up the Rhine to Basel, whence it was brought to Geneva by lorry. It arrived at the end of last year.

The head of the mole has 35 cutters. Behind the head on each side, two lateral hydraulic rams push supporting pads against the wall of the tunnel to form the supports for the machine as the head grinds into the molasse. The head is pressed against the rock by means of four axial rams with a stroke of 120 cm and an effective pressure of 480 tons. After boring these 120 cm the machine stops, a foot is lowered beneath the operator's cabin behind the head to keep the whole machine



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