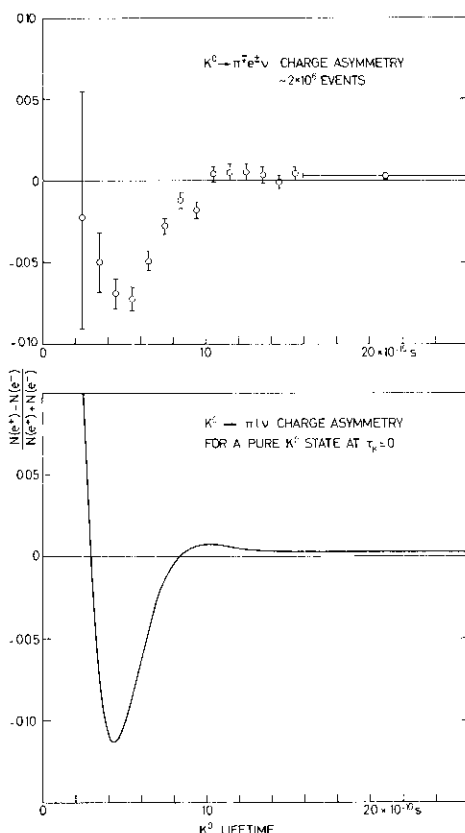
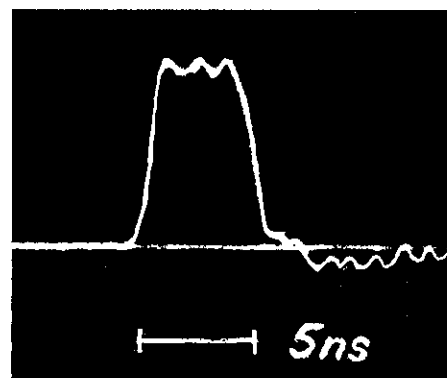




Charge asymmetry in the decay $K^0 \rightarrow \pi^\pm e^\pm \nu$ as a function of K^0 lifetime; 2×10^6 events.

Oscilloscope photograph showing a pulse 100 kV high and 4 ns long produced by the experimental generator developed at CERN.



2) on the selection rule $\Delta Q = \Delta S$ (charge change equal strangeness change).

Up to now a total of 3×10^8 events, including several million $K^0 \rightarrow \pi^+ \pi^-$, have been recorded.

The analysis of the data collected so far is not finished, but the experiment has demonstrated that it is possible to operate such a large set up of proportional multiwire chambers and to take data at a rate 100 times higher than similar experiments before.

electrodes. Beyond a certain field gradient, discharge is induced by the presence of free electrons in the gap. If the free electrons can be eliminated, the equipment can be operated in the supercritical range, where the charging voltage can be increased by up to forty times, thus providing in the subsequent discharge extremely short pulse rise and duration times. The presence of free electrons results however in an immediate transition from the supercritical to the critical range.

The principal sources of free electrons are those escaping naturally from the surface of a body from thermal and chemical field emission effects and those produced by ionization of the gas in the gap.

Gygi and Schneider's equipment seeks to eliminate these sources in a variety of ways:

- 1) The electrodes are of platinum or rhodium at the cathode and stainless steel at the anode. The atmosphere is argon at normal pressure and, above all, the charging time is very brief (40 ns). All of these reduce to a negligible value the probability of formation of free electrons by the electrodes;
- 2) The distance between the electrodes is very small which reduces the likelihood of the passage of cosmic rays;
- 3) The electrodes are of a special form and great care has been taken in their manufacture; the sides, for example, are coated with silicone rubber.

The electrode system is relatively wide which means that the number of discharge points is increased. To take advantage of this the present design of feed line comprises four 80 ohm lines in parallel, reducing the impedance to 20 ohms. Strict simultaneity in the discharge of the electrodes is ensured by a special

sion logic by a 2-fold coincidence between 2 trigger counters;

— the selection, by means of the chamber logic circuits, of those events giving twelve tracks one in each of the right and left-hand halves of the six wire planes in the MPC's (one track in the right and one in the left-hand of each plane). It should be noted that, in the case of the horizontal wires, the planes are divided into two distinct halves which are symmetrical on the left and on the right;

— the simultaneous recording of the signals of the electron and muon counters in time with the 2-fold trigger coincidence.

These events are then buffered in an on-line computer and recorded on magnetic tape.

The recording sequence is then finished. The data now have to be processed off-line to allow all the K^0 decay reactions to be identified, i. e. $K^0 \rightarrow \pi^+ \pi^-$, $K^0 \rightarrow \pi^\pm e^\pm \nu$, $K^0 \rightarrow \pi^\pm \mu^\pm \nu$, $K^0 \rightarrow \pi^+ \pi^- \pi^0$.

The identification procedure used is based on the information provided by the muon and electron counters and on spatial and kinematic reconstruction programs using the coordinates of the tracks in the three chambers. The K^0 decays into muons and electrons are not eliminated but retained to provide information:

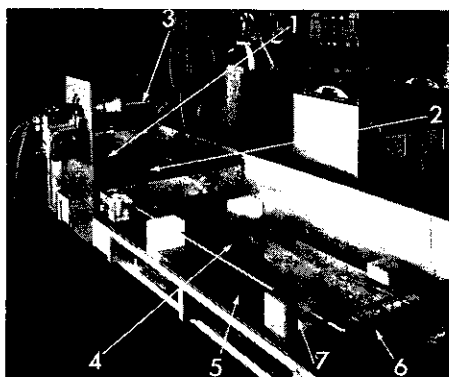
1) on the mass difference between K_S and K_L and

100 kV — 4 ns

High voltage, very short pulse generators with rise and decay times shorter than a nanosecond can find many applications in high energy physics for both experimental and accelerator equipment. E. Gygi and F. Schneider at CERN have just completed an experimental generator capable of providing 100 kV pulses 4 ns long, with rise and decay times of 0.6 ns and a repetition frequency of 1 Hz. It also has a low impedance — 20 ohms — and could thus be used in conjunction with step-up transformers.

The generator is of conventional layout, in that it comprises a charging circuit (a Marx generator plus a charging line) discharging into a line with the same characteristic impedance via a spark-gap. It differs radically from its predecessors in two respects: the very short charging time of the line (40 ns) and the special design of the spark-gap. This makes possible a charging voltage of 200 kV across 8 mm, at a pressure of one atmosphere or less, whereas in an ordinary spark-gap it would not exceed 5 kV in similar conditions.

Normally, the maximum voltage which may be applied to the electrodes of a spark-gap depends on the distance, the nature of the gas and its pressure, and the form of the



View of the pulse generator indicating —
(1) Marks generator; (2) pulse forming network;
(3) UV flash lamp; (4) inner electrode; (5) part of
ground electrode; (6) terminating resistors;
(7) polyurethane support.

generator producing short ultraviolet pulses. So far the equipment has been successfully tested to 10^5 pulses with a charging voltage of 200 kV.

From the PS to the West Hall

The next two stages in the PS improvements programme are the booster and the West Hall. Work is proceeding smoothly on the former (see for example the July issue of CERN COURIER) but very little has so far been said about the West Hall and its adjoining buildings, which will house not only BEBC but also the Omega project and a whole set of PS experiments. It has not, however, been forgotten and the major part of transfer line TT2, through which the protons originating from the PS will be directly transferred to the West Hall target areas, has recently been completed.

The design of this 540 metre-long line, which is subject to both horizontal and vertical deflections, and which passes beneath the ISR rings, is very similar to that of tunnels TT1 and TT2 supplying the two rings (see vol. 10, pp. 280 and 316). It is however required to transport in addition to fast ejected protons from the PS, slow ejected protons also.

Proton transfer tests have just taken place along 80 % of its length with excellent results.

In fast ejection, with the magnet currents set to the calculated values, impact points only 5 to 15 mm from the centre of the vacuum chamber were obtained at the end of the line which were reduced to zero after minor adjustment. Moreover, this was achieved with a beam oscillation of 14 mm maximum relative to the chamber axis.

Slow ejection can give rise to problems because of small changes in momentum (about 1 %) over the spill

time. The slow ejection system has not yet been installed, so the effect was simulated by making slight variations in the momentum of fast ejected particles. All seems well as the maximum departure from the straight and narrow fell well within the vacuum chamber limits and did not exceed 15 mm.

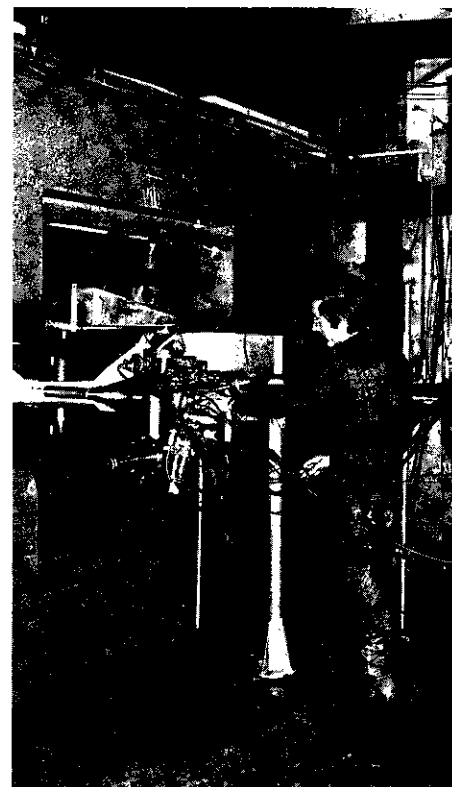
Radiation levels over the entire length of the tunnel also proved to be very low.

The whole of the beam line system passing through the West Hall is scheduled for installation at the beginning of 1972, and should be completed at the end of April, 1972.

45 cm³ polarized target

Continuous progress has been made in the field of polarized proton targets largely because of developments in the techniques associated with target temperatures and high magnetic fields (superconductivity) and by the use of new substances. In many respects, CERN has been a pioneer here, and CERN COURIER has already given accounts (vol. 9, page 300 and vol. 10, page 112) of improvements brought about by the use of alcohols as the material to be polarized, the use of helium 3 instead of helium 4 as a coolant and the polarization of deuterons.

Now at CERN the longest polarized target ever built (15 cm long and 2 cm diameter) has been put into operation. It is cooled by means of a new cryogenic system designed by J. Vermeulen (with advice from P. Roubeau of Saclay), comprising a helium 4 pre-cooler working at 2.5° K associated with a very small pumping system and a horizontal liquid helium 3 cryostat which forms part of a closed-circuit in which the pumping system has an effective pumping speed of 200 l/s. The rate of



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cooling the system can provide is 100 mW at 0.55° K.

The target is also designed so that the particle beam striking it, enters the axis of the cryostat. The beam is identified by two scintillation counters connected in coincidence situated, actually inside the cryostat, at a distance of 8 mm from the target. The special feature of the arrangement is that a very wide free angle is left around the target for secondary particle detection. Moreover, the magnetic field of 2.5 Tesla which is obtained from the ETH magnet is made highly uniform by the addition of pole pieces to one side according to an arrangement suggested by Ö. Runolfsson. This magnet normally gives 1.0 Tesla in a volume of $1 \times 1.5 \times 2 \text{ m}^3$.

Polarizations equal to 60 % were obtained during the initial tests, with the cavity filled with butanol spheres. The target is at present being used in an experiment intended to measure the polarization in K⁻p charge exchange.