4. *Pattern produced by pointing a camera into a single block of lead glass with a photomultiplier against its far surface. The block is 48 cm long and of square cross-section, 4.5 × 4.5 cm². The photograph was taken at Cornell.*

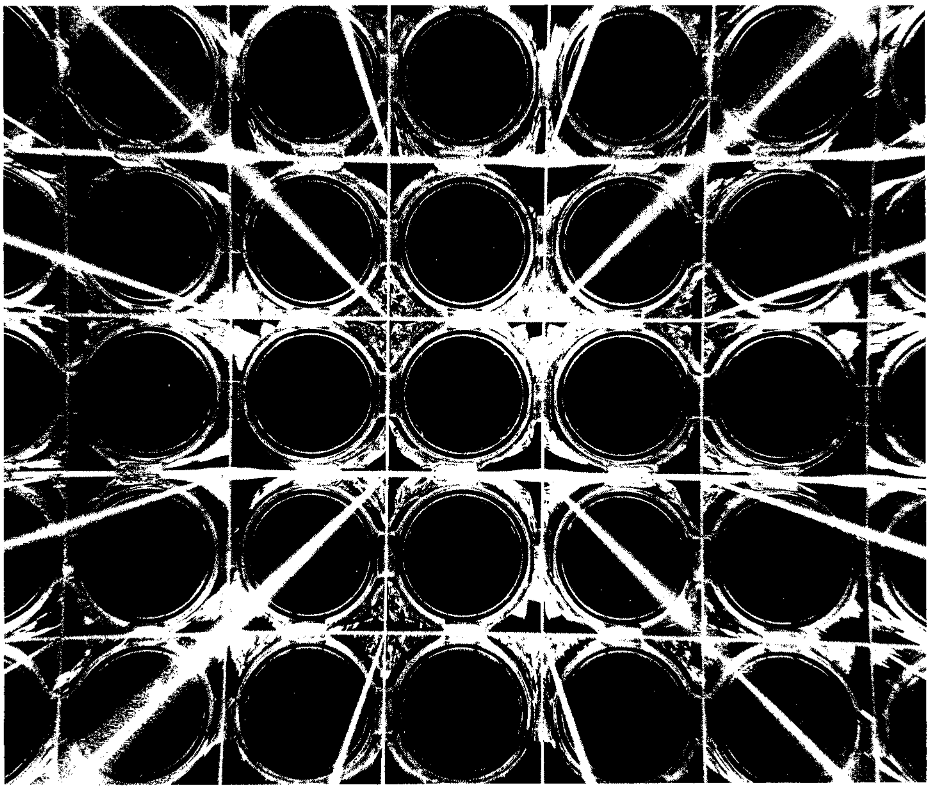
(Photo by Dale Carson)

of about 300 MeV) by having other detectors in action in a hybrid set-up. Two multiwire proportional chambers will be installed close to the streamer chamber volume and shower counters will add an energy loss measurement. About 100 000 pictures showing scattering with high transfer of energy are hoped for and they will be measured on two HPDs at DESY.

The second experiment by a Cornell group will use a large aperture magnet filled with multiwire proportional chambers (about 20 000 wires in all). About half the chambers are now complete and tested. To avoid flooding the chambers with unwanted data, a very clean incoming electron beam is needed (and has been achieved up to the magnet input) as well as special manoeuvres (such as horseshoe shaped shields around the beam path through the chambers to prevent low energy electrons produced by the beam swamping the chambers). An event rate of a few per second is anticipated and, when the system is eventually operating, it will obviously out-pace the capabilities of the streamer chamber.

At present the experimental programme involves about 80 physicists. Within the present scope of the programme and support facilities, about one more group could be accommodated. This is a small enough number to enable the Laboratory to maintain its university atmosphere which is unique among high energy physics research centres. The current budget provided by the National Science Foundation is about $ 3.5 million per year.

Future developments at the Laboratory depend heavily on the progress of the superconducting r.f. accelerating cavities. As reported in the June issue (page 165), encouraging results have been obtained with the eleven cell test section which was installed in the synchrotron earlier this year.



4.

It achieved the first ever acceleration of beams to GeV energies using a superconducting accelerating structure. The test section has now been removed to attempt to improve its Q value by tidying up the niobium spacer located between the two halves of the structure proper.

If these cavities can be mastered, they will make it possible to pour more energy into the accelerating beam to compensate for the high energy losses due to synchrotron radiation which rise rapidly with increasing energy. At present, for 12 GeV operation, about 1.8 MW are pumped into the five cavities distributed around the ring and a high proportion of this is lost due to the resistance of the copper walls of the cavities. A superconducting cavity would lose only about 20 W due to residual resistance in the cavity (though 40 kW of refrigerator power would be needed to prevent temperature rise).

If the superconducting cavities succeed, a 25 GeV electron synchrotron could be feasible with rebuilt magnets in the existing machine tunnel. A bigger jump in energy, however, would be much more desirable and some thought has been given to a new 50 to 70 GeV ring on a different site. Sums of money in the 30 to 50 million dollar region would be needed for such a project.

DUBNA
Determining the life of the positive muon

A further big increase in the accuracy of measurement of the life of the positively charged muon has been achieved at the Joint Institute for Nuclear Research by a team leaded by

V. Zinov. The positive muon decays into a positron, a neutrino and antineutrino with a lifetime now determined to be 2.19711 ± 0.00008 μs.

The first relatively accurate measurements (1 part in 10^{-3}) were made by several groups during 1962/1963. After an interruption of ten years, J. Duclos et al., using a new technique, succeeded in increasing the accuracy by several times (2.1973 ± 0.0003 μs, as reported in Phys. Lett. 47 B, 491, 1973). However, these and the preceding measurements suffered from a basic limitation on accuracy which stemmed from the small solid angle over which the equipment could record positrons.

The special feature of the new technique is that the positrons resulting from muon decay can be recorded by a Cherenkov counter capable of operating in 4π-geometry. Consequently it has been possible not only to increase the speed at which statistics could be collected, but also to reduce the background and eliminate the effect of the asymmetric way in which the positrons emerge. In addition, in view of the high positron energy of decay it has been possible to record them with the discriminator set at a fairly high level and eliminate the background of low energy particles.

The measurements were carried out on the synchro-cyclotron, generating a pure muon beam with a momentum of 130 MeV/c and an intensity of 7×10^3 particles. The Cherenkov counter was filled with water which acted also as a target, in the centre of which the muons were stopped. Only those events which corresponded to the appearance of just one muon and one positron within a gate 20 μs long were recorded by a computer working on-line. Measurements were made during four runs totalling 100 hours of accelerator operation during which 10^9 useful events were observed.

A further substantial increase in accuracy could be achieved with such a set-up by improving the high speed positron detectors and exploiting to the full their 4 π capability.

BERKELEY
Turn of the heavies

Storming down the hill from the SuperHILAC in the early hours of 1 August a beam of C^6 ions entered the Bevatron and 2.5 μA were accelerated up to an energy of 0.56 GeV/nucleon corresponding to 0.5 T in the magnets. This combination of the modified heavy ion linear accelerator and the rejuvenated Bevatron at the Lawrence Berkeley Laboratory, christened the Bevalac (June issue, p. 213) is now the most powerful heavy ion accelerator in operation. Not content with this first effort, the team headed by H. Grunder and A. Ghiorso set about tuning the transport line and by the following afternoon had injected 7.7 μA — later 10 μA — and had raised a beam of 1.6×10^9 particles to the maximum energy of 2.1 GeV/nucleon.

The transport line is a tricky part of the hook-up as the control system is, for the present, rather rudimentary, but before the end of the day some 60 % efficiency in transmission had been achieved and 15 μA injected. Moreover a beam of 4.5×10^8 ions had been successfully extracted. Work over the next few days pushed the intensity of the injected beam of C^6 ions up to 60 μA and on 11 August, the beam was used in an experiment on the superdense nuclear states.

That completed, a new run was started with Ne^{10} ions and relatively quickly a beam of 16 μA was being injected into the Bevatron and an extracted beam of up to 1.5×10^8 ions at full energy was being recorded in the external beam channel, and was being used for experiments by physicists from LBL and SLAC.

H. Grunder and A. Ghiorso exchange congratulations during the lab's celebration of the Bevalac's success.

Tests in the near future will be made with A^{18} ions and it is hoped to work up in due course to Kr^{36}. For much heavier ions to be accelerated the vacuum system of the Bevatron would have to be improved. For the immediate future the most important job is to get a new computer system into operation which can take over the control of the entire beam transport and acceleration process.

KEK
Linac operates

First beams were accelerated in the KEK linac of the National Laboratory for High Energy Physics at Tsukuba in Japan at the beginning of August. A beam intensity of 3 mA at 20.3 MeV and a pulse length of 20 μs was