The basic data on a cyclotron with a pole-piece diameter of 120 cm are given. The arrangement of the principal parts of the system, the design features of the individual units, the radio frequency (rf) installation, the method of measuring and correcting the magnetic field, the features of the deflection system, and the method of focusing the beam on a remote target are all described. Deuterons are accelerated to an energy of 13.7 Mev in this machine. The use of a deflection system with focusing properties makes it possible to use magnetic quadruple lenses with small apertures which bring practically the entire deflected beam to a remote target. The parameters of the machine are such, that it will be possible to increase significantly the energy of the accelerated ions in the future.

In 1955, the Scientific Research Institute for Electro-physical Apparatus and a group of colleagues of the Institute for Atomic Energy, Academy of Sciences, USSR, were presented with a problem: to develop a cyclotron which would provide intense beams of protons, molecular hydrogen ions, deuterons, α particles, and multiply charged ions. It was required that the cyclotron be reliable in operation, relatively simple to operate, and have adequate shielding against penetrating radiation. In order to carry out experiments with a minimum level of background radiation from the cyclotron, the ion beam is steered through the main shielding wall into an experimental area which has its own shielding. Conditions have been created for experiments with fast neutrons and for determining the neutron velocity spectrum by time-of-flight methods. The cyclotron can also be used for producing artificial radioactive isotopes. In the design of the cyclotron, a good deal of attention has been paid to radiological safety techniques; the basic operation of the machine is carried out by remote control.

The cyclotron laboratory is located in a two-story building with a sublevel. Figure 1 shows a plan of the first floor of the cyclotron laboratory and the arrangement of the apparatus. Part of the auxiliary equipment is located in the sublevel. The second story houses laboratories, a library, a construction department and other installations.

The constructional work for this cyclotron laboratory was carried out by the Leningrad Construction Institute.

Electromagnet and Correction of the Magnetic Field

The cyclotron magnet is shown schematically in Fig. 2. The beams and uprights of the electromagnet are fabricated from three sections made up of St-3 sheets 40 mm thick. The weight of the heaviest section is less than 12.5 t, so that the magnet can be assembled and disassembled in the cyclotron room by means of a bridge crane with a loading capacity of 15 t.

The winding of the electromagnet consists of two series-connected coils 6.5 t in weight, which are made up of copper tubing with dimensions 20 × 5 mm. Each coil consists of seven sections which are cooled by distilled water. All fourteen sections of the windings are connected in parallel across the water manifold. The water flow in each parallel branch is monitored by means of a flow switch.

The diameter of the pole pieces of the magnet and the ceiling of the chamber is 1200 mm; the distance between the pole pieces is 345 mm; the ceiling thickness is 72.5 mm; the gap between the top and bottom is 170 mm. On the pole pieces of the magnet, there are two auxiliary uncooled windings of 500 turns each which are designed for a maximum current of 5 amp.

The power supply for the main windings of the electromagnet is a motor generator which provides dc power at 135 kw. The current in the windings is stabilized with an accuracy of 0.03% for a line-voltage change of ±10% and a line-frequency change of ±2%. The stabilization is realized by means of a standard BT-4 unit, which operates on a change of voltage in a shunt connected in the circuit of the magnet coil. The current is controlled by potentiometers, which are located at the central control panel.

The design of the magnet has been carried out by N. N. Indyukov, E. A. Bezgachev, and A. V. Klimov, under the direction of B. V. Rozhdestvenskii and B. E. Gristkov.
Fig. 1. Plan of the first floor. 1) Location of rf equipment; 2) central control panel; 3) installation for measuring apparatus for operation with neutron beams; 4) cyclotron rooms; 5) auxiliary room; 6) experimental room; 7) acid room; 8) storage-battery room; 9) shield room; 10) motor room; 11) transformer substation; 12) mechanical shop; 13) laboratory with physical equipment for which the foundation is required; 14) vestibule; 15) hoistable shielding gates; 16) entrance with rotatable shielding blocks.