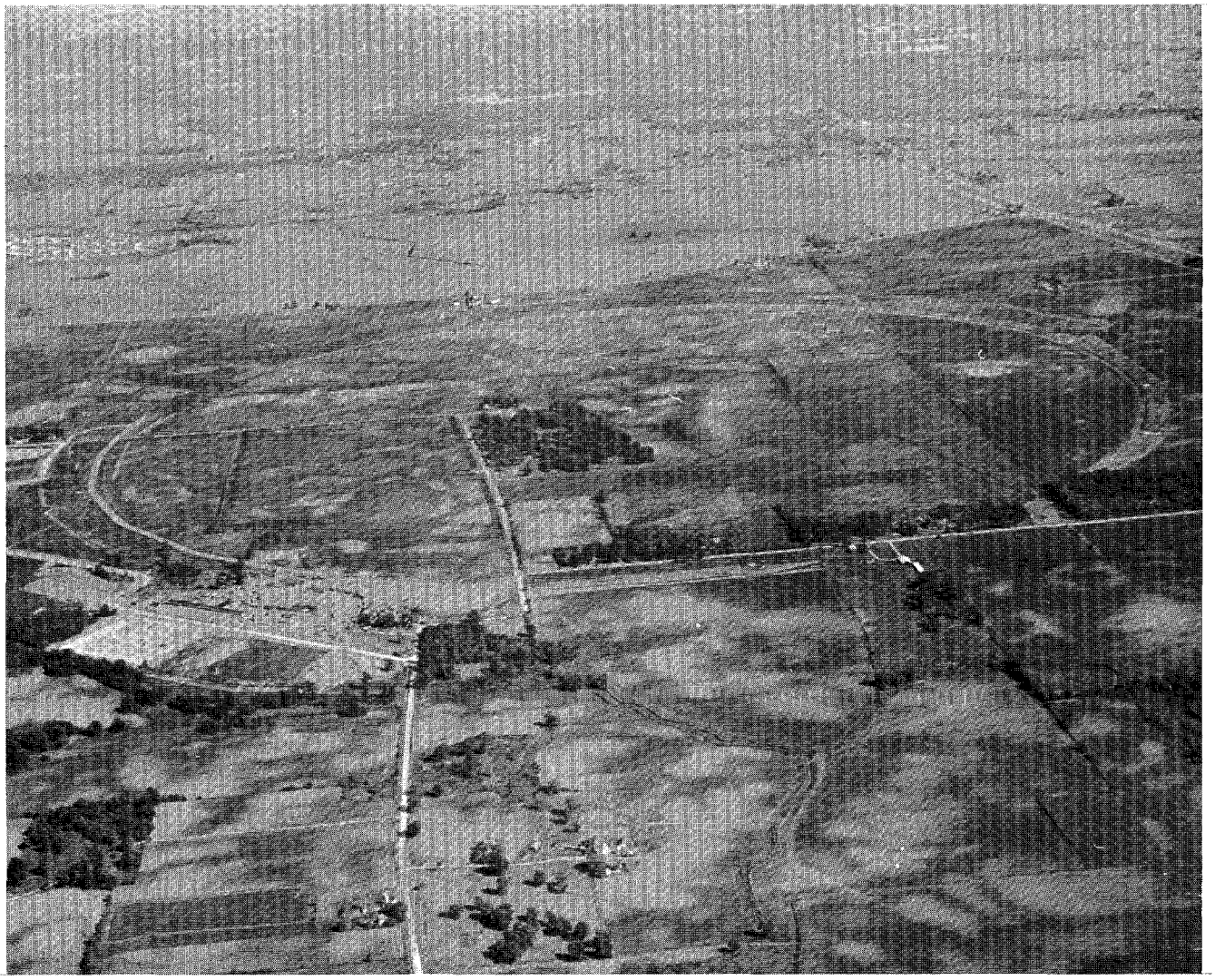
national accelerator laboratory FERMILAB-NAL-031

MONTHLY REPORT OF ACTIVITIES

September 30, 1969



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The cover photograph is an aerial view of the site, looking east-southeast. Excavation and clearing work outline the main ring and the road inside it. The linac, booster, and cross gallery are at the lower left. The Laboratory Village is above and to the left of the main ring. Wheaton, Warrenville, and the East-West Tollway are at the top of the view.

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MONTHLY REPORT OF ACTIVITIES

F. T. Cole

September 30, 1969

Abstract: This report covers the activities of the National Accelerator Laboratory in September, 1969.

General

1. Construction Progress. The cover and Fig. 1 are recent aerial views of the construction area, showing the progress on the contracts discussed below.

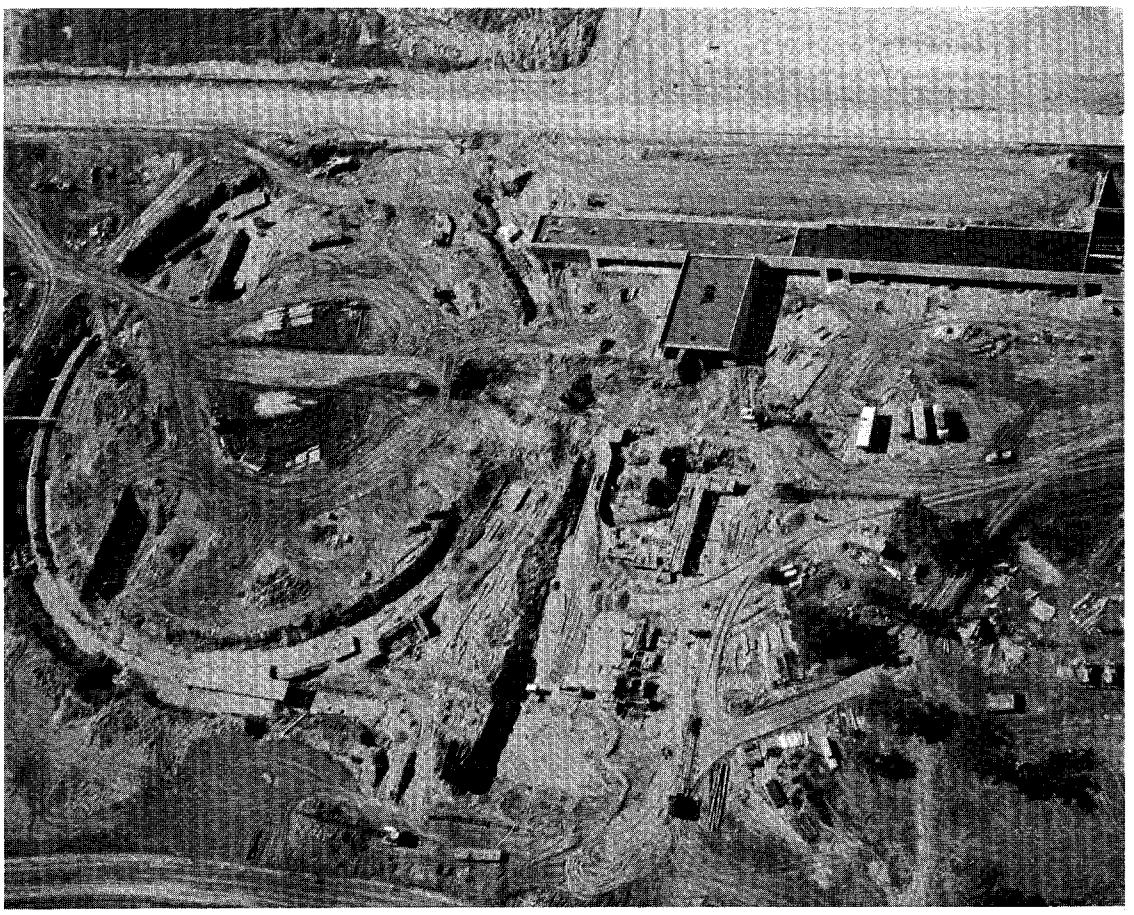

Fig. 1. Aerial view of the Injection area. The Cross Gallery work extends downward from the Linac. Excavation for the Transfer Hall is at the bottom.

a. Linac Building. The walls and roof of the equipment gallery are almost complete, as can be seen in Figs. 2 and 3. Completion of the preaccelerator "head house" is being moved forward to provide for installation of the high-voltage set when it arrives (see "Linac" below). The building is 74% complete, somewhat ahead of schedule.

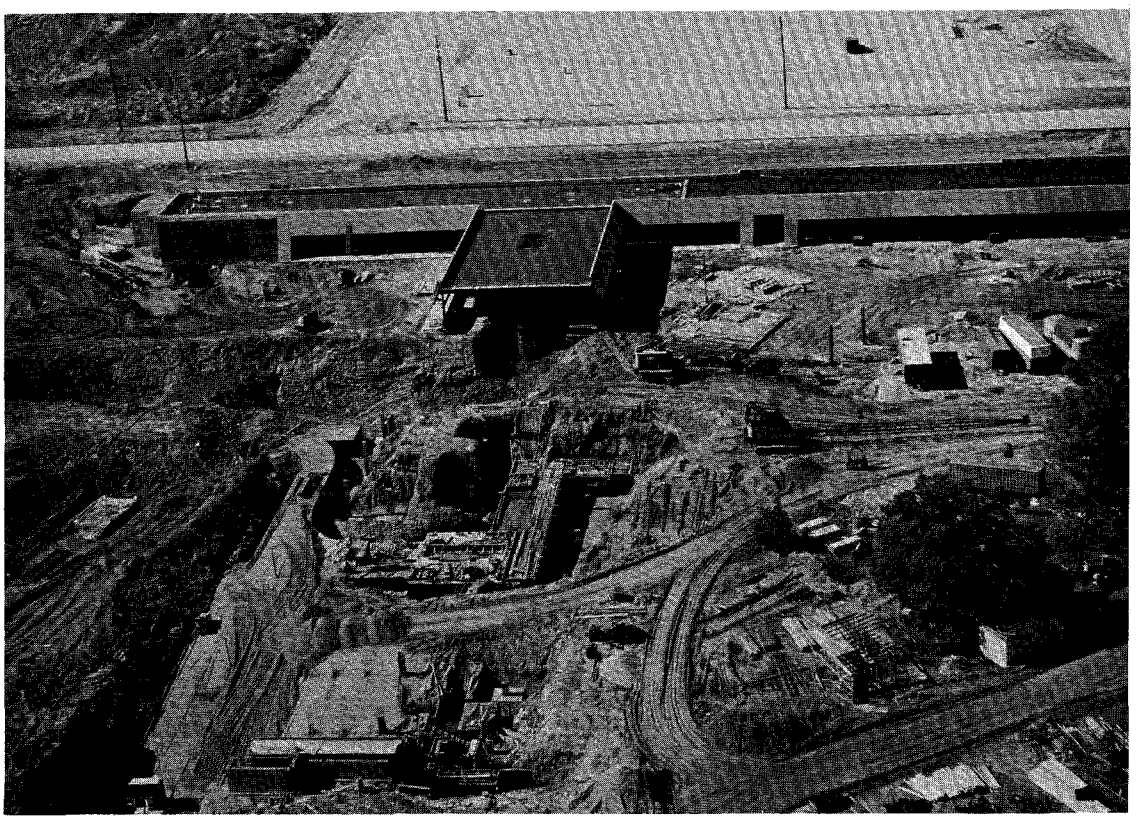

Fig. 2. The Linac Building. Progress on the roof and wall can be seen, as well as the beginning of structural work on the Cross Gallery.

b. Booster Enclosure. The underground-enclosure structural work has been completed over most of the circumference and earth backfill placed. Figure 4 shows this work. Work has begun on the linac extension and on electrical utilities in the enclosure. The building is 40% complete and is on schedule.

c. Cross Gallery. Structural erection in under way. It is visible in

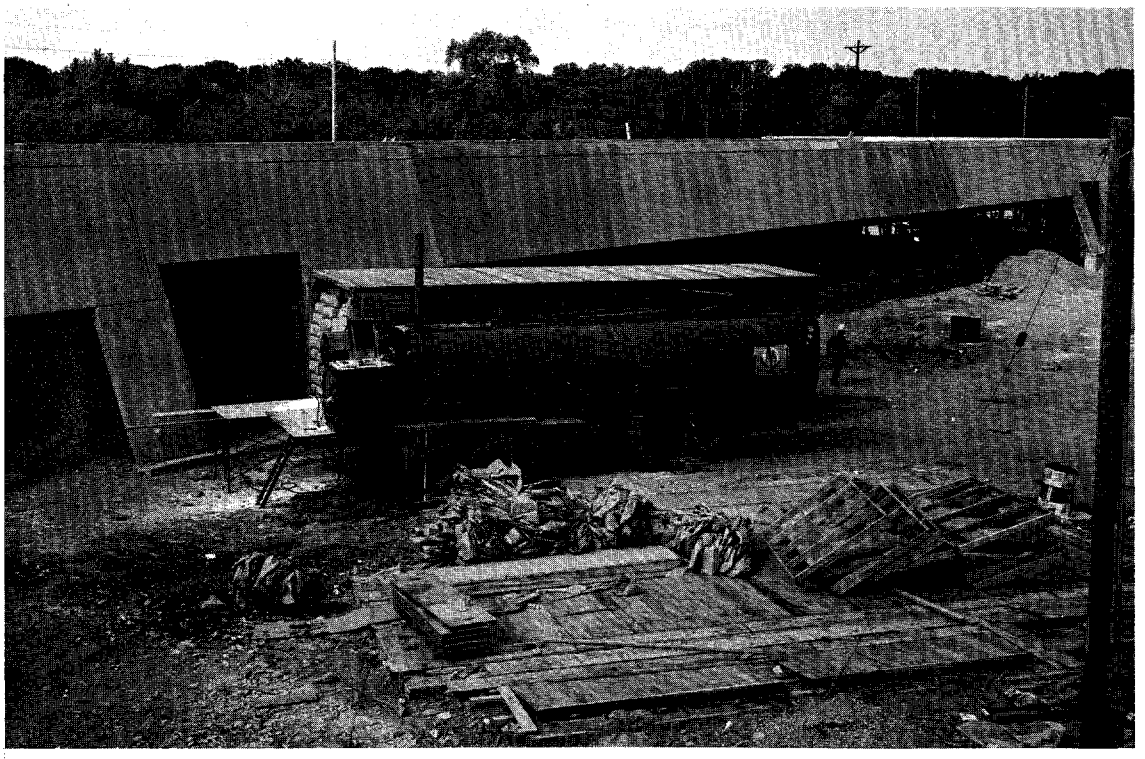

Fig. 3. A closer view of the Linac Building.

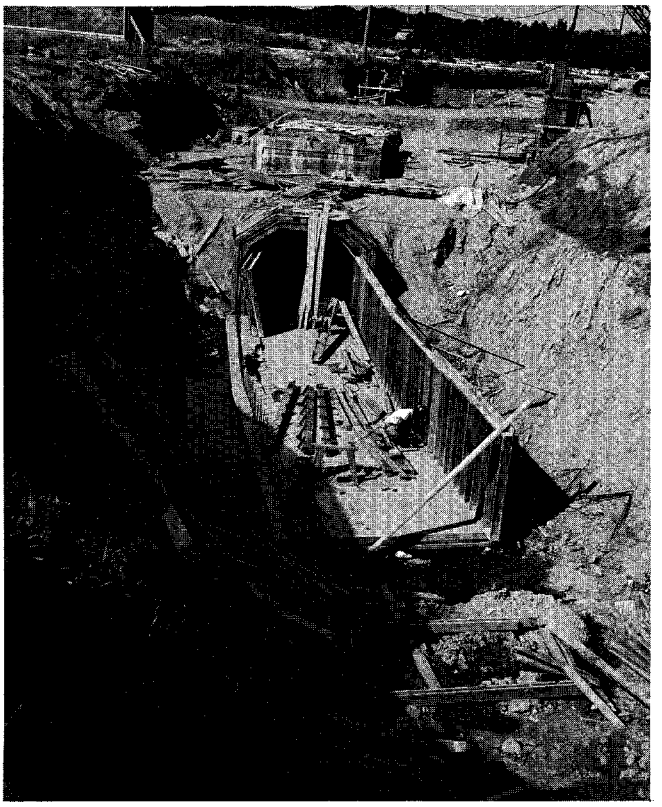

Fig. 4. Backfilling work on the Booster Enclosure.

Fig. 1. The building is approximately 15% complete and is on schedule.

d. Main-Accelerator Enclosure (Phase I). Excavation is beginning, as shown in Fig. 5. Work is also in progress on the main-ring road, which can be seen in the cover photograph. The job is 3% complete, on schedule.

Fig. 5. Excavation for the Transfer Hall.

e. Industrial Building and Roads. Excavation, shown in Fig. 6, is beginning for the industrial buildings. The job is 3% complete, on

schedule. The rough roads in the industrial area are complete and are

in Fig. 7.

Fig. 6. Site preparation and excavation work for the Industrial Buildings.

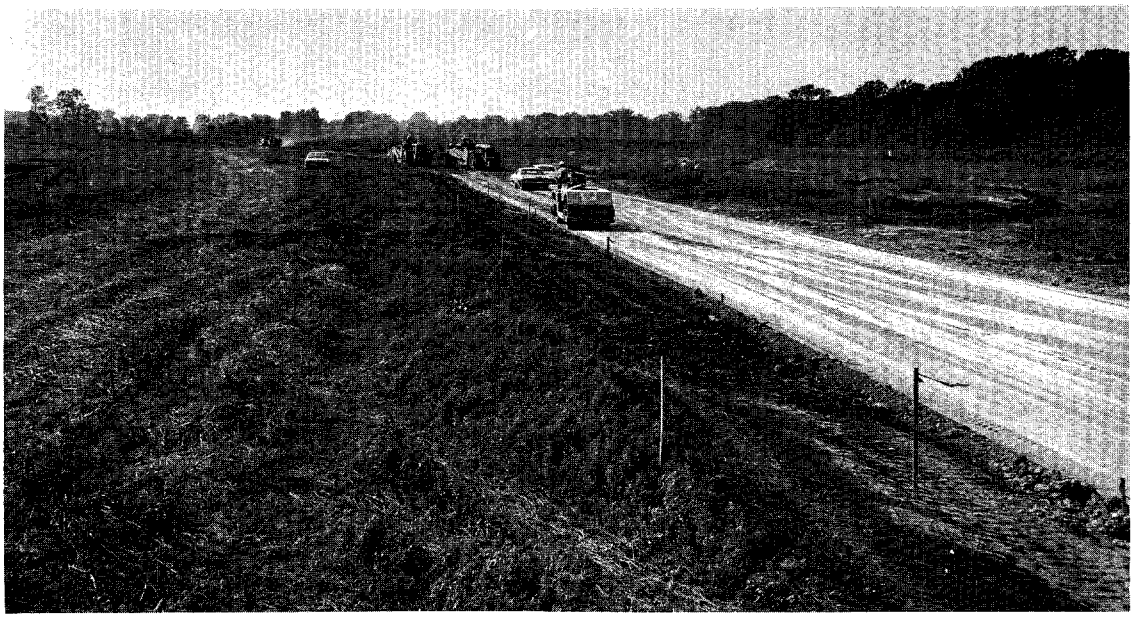

Fig. 7. The Industrial-Area Road.

2. New Construction Contracts. Notices to proceed have been issued on Phase II of the Cross Gallery, for $678,428 and on Phase II of the Utility Plant, for $760,000 and Enclosure Piping ($137,000) in the Booster and Utility Plant areas. In each case, happily, the job will be done by the contractor already working on earlier phases of the same structures.

3. Site Manager. Rudolph Dorner is joining the Laboratory staff as Site Manager. He will supervise operation of the Laboratory Village and of all site areas except those involving technical buildings and facilities, which will be the responsibility of the Plant Engineer.

4. Theoretical Physics Section. A Theoretical Physics section has been set up. Five physicists have joined the Laboratory staff as initial members. David Gordon is acting head of the section.

5. Laboratory Staff. On September 30, the Laboratory has 520 employees, including 126 engineers and scientists.

Linac

1. 10-MeV Prototype. Ion-source studies continued through most of September, utilizing the beam-emittance measuring equipment described and pictured in last month's report. Bright 750-keV beams with currents over 250 milliamperes and a high percentage of protons have been observed.

Realignment of the 10-MeV linac with all elements installed in the beam-transport lines has been completed. The electric fields have been remeasured and small corrections made. The 10-MeV beam-diagnostic system has been completed. The 10-MeV linac will resume operation early in October.

2. 200-MeV Construction. The 800-kV high-voltage set and ion-source terminal has been shipped from Switzerland. It is scheduled to arrive in

Chicago in the middle of October. Arrangements are being made for its installation in the permanent linac building.

About five-eighths of the linac technical components have now been committed to fabrication. The funds committed are slightly less than the amount that had been estimated for these components. Fabrication of copper-clad steel is in progress at the Lukens Steel Company. Rolling of the next tank will begin early in October. Practically all major components of the linac rf system are also in fabrication.

Booster

1. Magnet Program. Testing of the first end pack for the F magnet has been completed. On the basis of these measurements, we have decided to proceed with the production punching of F laminations. The changes desired are so small that they can easily be incorporated in the end pack, which is being developed further with the Accelerator Theory section. The D-magnet end pack will be measured in October, and it is expected that production punching of D laminations will also begin shortly.

Impregnation of a new prototype F magnet has been completed and a D magnet is under way. The F magnet was remarkably clean inside. Rewelding of the end plates caused some cracking of the sidewalks. In the D magnet, the end covers will be pre-welded to avoid this problem.

A prototype magnet and power supply has successfully gone through a 24-hour run at full excitation with no deleterious effects on the power supply, the magnet, or the vacuum system were observed.

2. 200-MeV Beam Dump. The first 200-MeV beam dump has been completed and vacuum-tested in the Laboratory shop and moved to the

construction site for installation. The second beam dump is now being fabricated.

Main Accelerator

1. Magnet Program. The first 20-foot B2 bending magnet has been completed. It is shown in Fig. 8. It was built in our own laboratory. There are, of course, some imperfections in this first-of-a-kind magnet, but valuable information has been obtained on coil tolerances in assembly, on assembly techniques, and on the mechanical behavior of the complete structure.

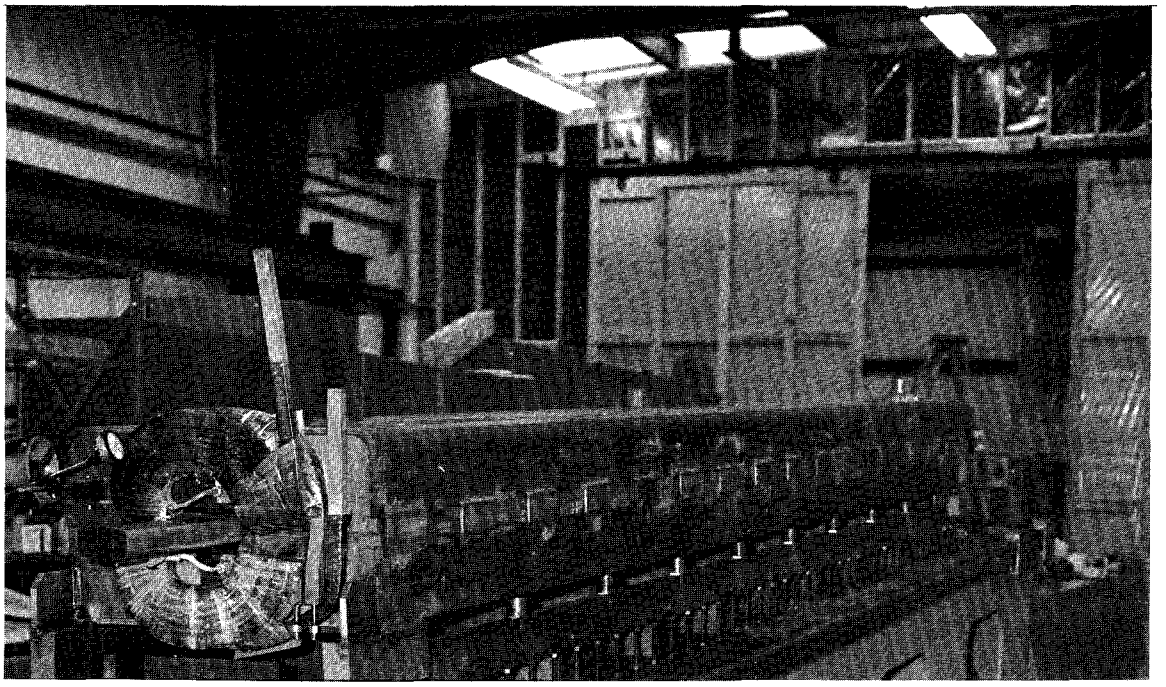

Fig. 8. The first 20-foot B2 magnet.

This magnet will be used in testing of measuring systems and testing of the magnet installation vehicle.

A new and simplified method of fabricating bending-magnet coils, suggested by Robert Sheldon, is being tested. The coil for each magnet will be

built as three separate coils, a 4-turn inner coil close to the beam where accurate tolerances must be maintained, and two outer "window" coil that can be built to standard commercial tolerances. All three coils will have saddle ends, rather than the previous T ends.

In the new design, the B2 magnets will have slightly altered dimensions. In the B1 magnet, it has been found that a significant cost saving can be achieved by changing from a 24-turn to a 12-turn coil. Magnetic redesign of the B1 magnet for this change is almost complete.

A building has been rented in West Chicago, just north of the site in which to produce inner coils. It is planned that the Laboratory will set up this operation and turn it over to a contractor when it is running smoothly.

Accelerator Controls

A Task Team on controls has been set up to supervise the design of the control systems for the individual accelerators and for the accelerator facility as a whole. Ernest Malamud is the Controls Coordinator.

At this time, the concept of the whole system can be roughly described as follows: there will be a number of very small computers placed at stations where signals are grouped together and digitized. These computers will transmit information to the larger computers (which are of the size of the SDS Sigma-2 computers the Laboratory now uses for accelerator-control development) that will control the individual accelerators. There will be one each of these larger computers for linac, booster, main accelerator, and beams. The beams station will control the external proton beam, the target stations, and some secondary beams of a permanent nature. There will also be one central computer to coordinate all control functions.

Radiation Physics

1. Soil Activation. The first phase on the experiments to measure soil activation by strongly interacting high-energy particles. The preliminary results appear to show that there will be no special problems with contamination of underground water under the extraction straight section in the Transfer Hall.

Experimental Facilities

Task forces have been organized within the section to work in detail on various aspects of experimental utilization. There are task forces on Experimental Areas 1 and 2, on secondary-beam design, shielding, magnets, beam systems, detectors, and on spectrometer systems. These groups will start from the 1968 and 1969 Summer Study reports and develop firm plans in their areas of responsibility. A series of regular meetings is planned with physicists from other institutions to review and develop further the work of these task forces.