national accelerator laboratory FERMILAB-NAL-057

MONTHLY REPORT OF ACTIVITIES

April 30, 1971

THE LAST MAGNET GOES INTO THE MAIN RING

Operated by Universities Research Association Inc. Under Contract with the United States Atomic Energy Commission

FORTHCOMING MEETINGS AT THE LABORATORY

Program Advisory Committee May 14-15

THE COVER: Men from Belding Engineering Co. installing the last magnet (no. 1,014) in the Main Accelerator on April 16. E. L. Goldwasser and F. T. Kleber are at the right.

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MONTHLY REPORT OF ACTIVITIES

F. T. Cole

April 30, 1971

Abstract: This report summarizes the activities of the National Accelerator Laboratory in April, 1971.

Main Accelerator

The last Main-Accelerator magnet has been installed in the Transfer Hall. The occasion is shown on the cover and in Fig. 1. In a sense, this is

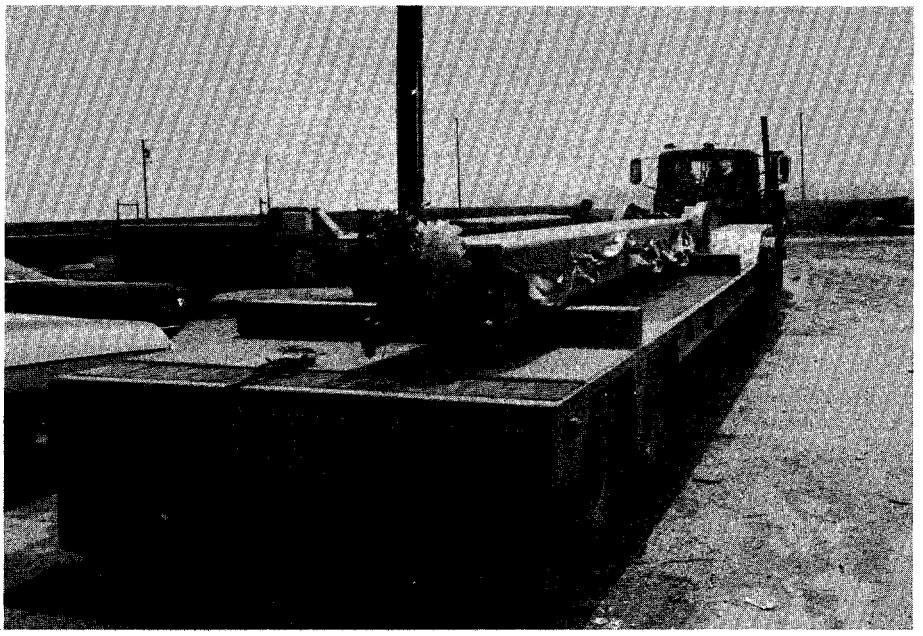

Fig. 1. The last magnet leaving the factory in Industrial Building 1 en route to the ring.

but one part of the installation and much remains to be done before the magnets can be excited. In the final push, some substandard magnets were installed and these must be weeded out and replaced.

Two complete alignment circuits of the ring have been carried out, with closing errors of 0.059 and 0.106 inches. Differences between them indicate that Sector A has become quite stable, but that some of the more recently covered sectors are exhibiting ground motions of as much as 0.035 inches per month. Vertical adjustments of magnet positions have been made and horizontal adjustments are in progress.

With the power-supply testing just beginning to take place, the main-ring tunnel is being secured every night. Four 2-man teams complete the search and close the interlock chains in approximately 1-1/2 hours.

There was a preliminary attempt in April to inject a low-energy beam from the Booster into the completed sectors of the Main Accelerator. It was not successful.

Booster

Almost all of April was spent in a shakedown period on the Booster. The magnet power supply is operating with good stability and experiments are being performed to accelerate beam. At the time of writing, a proton energy of 4 GeV, close to transition energy, has been achieved. Most of the work has been aimed toward achieving stable operation of the high-power rf systems and on bringing the phase and radial feedback loops of the beam-controlled low-level rf system into operation. When that is done, it should be possible to go through the transition region.

Linac

The Linac has operated as an injector for almost all of April. An experiment has been started to investigate phasing of the rf between tanks and preliminary results give some encouragement.

Radio Frequency

There has been considerable work done on the Booster rf system in April. In addition to the work on stabilizing high-power systems, the control system has been largely completed and it is now possible to operate the rf system from the main Control Room.

Meanwhile, installation is proceeding on the Main-Accelerator rf system. All anode power supplies, 5 cavities, 5 modulators, and 2 bias supplies are in place. The entire cooling-water and about 80% of the electrical cabling have also been installed.

Beam Transfer

The electrostatic-septum modules and the Lambertson septum magnets of the Main-Accelerator extraction system have been installed in the Transfer Hall.

The first magnets have been installed in the vertical bend that brings the external beam up to the Neutrino Laboratory. They are shown in Fig. 2.

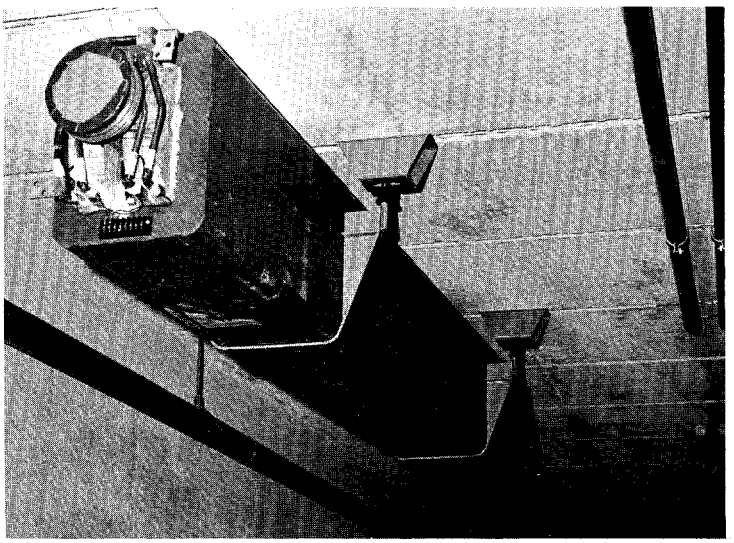

Fig. 2. The first vertical dipole magnet installed in Enclosure C of the Proton Beam Enclosure.

Installation work is also going on in the main beam dump, as seen in Fig. 3.

Fig. 3. Interior of the main beam dump. The aluminum billet in the center is part of the primary beam stop. The surrounding iron billet shield is partly in place.

Experimental Facilities

1. Proton Laboratory. Design concepts of the Proton Laboratory have been fixed. Figure 4 is a sketch of the layout.

The proton beam is bent 5.5° to Beam Line P going to the Proton Laboratory, east of the Neutrino Laboratory.

There will be a switch yard just north of Road B to split the beam to target areas PL, PC, and PR. It is planned to construct enclosures or pits for specific experiments downstream of the targets. Sheet-piling walls will be driven into the ground, the space between the walls excavated, and a gravel base put down for the experiment. After the experiment is completed, it will be possible to remove the piling and fill in the excavation. A new housing for the next experiment can then be built.

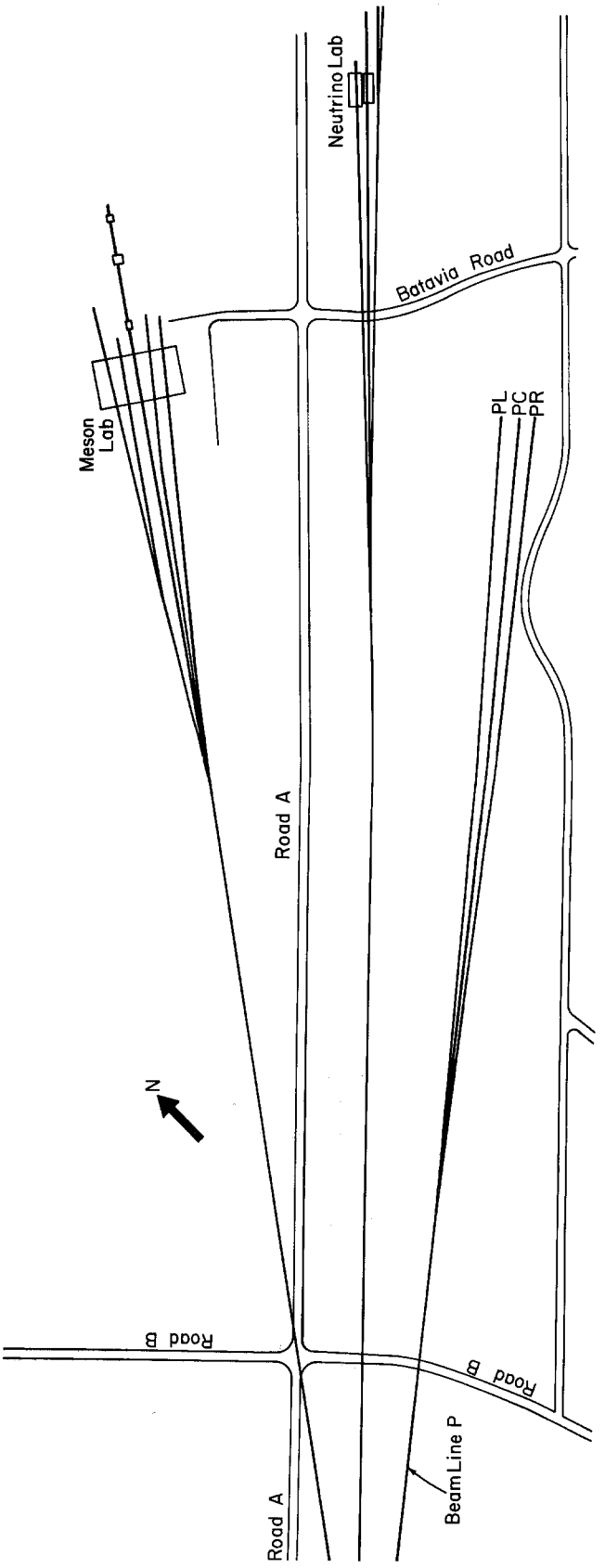

Fig. 4. Sketch of the Proton Laboratory concept.

2. Meson Laboratory. Design of the utilities systems has been completed. Proton-beam dipole and quadrupole magnets are being fabricated; 9 dipoles and 4 quadrupoles have been completed.

3. Bubble Chambers. Design work was completed on the building to house the 30-inch chamber, Laboratory ND. Bids were received on April 30, and a contract is expected to be let shortly. With this award, the entire Neutrino Laboratory will be under contract.

The vacuum tank for the 15-foot chamber was completed, as can be seen in Fig. 5, exactly on schedule. Machining of the inner chamber body has begun at the fabricator's plant in Birmingham, Alabama.

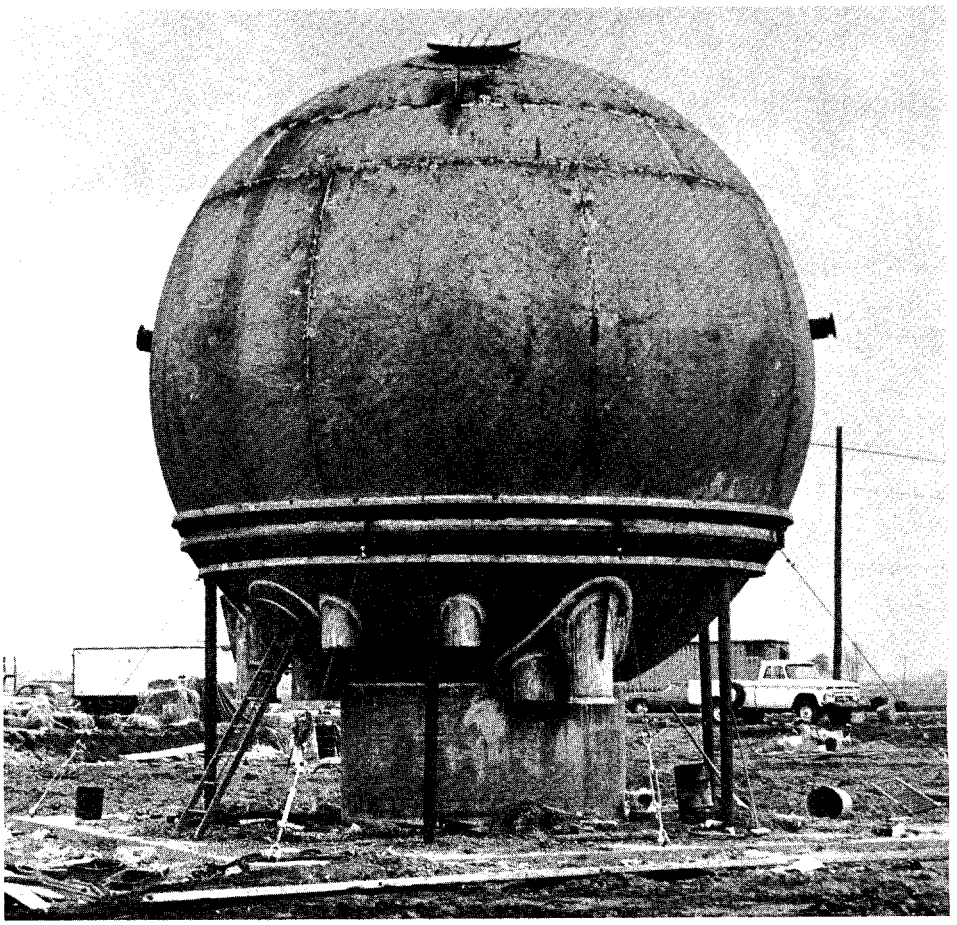

Fig. 5. Completed vacuum tank of the 15-foot bubble chamber.

A list of new proposals received at the Laboratory is appended to this report.

Construction

1. Proton Beam Enclosure. The job has been backfilled almost up to the beam dump. Most construction work is now in the woods just south of Road B. This work is shown in Fig. 6. The entire contract is 79% complete.

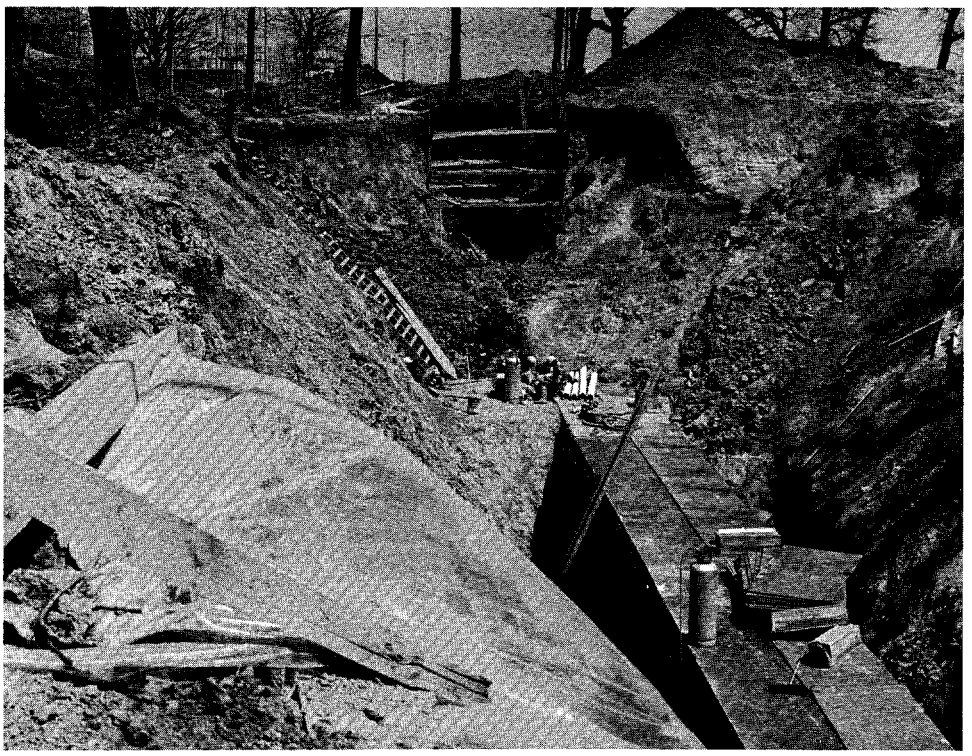

Fig. 6. The Proton Beam Enclosure going through the woods. The Electrical Substation and the power line can be seen in the distance.

2. Meson Laboratory. The first phase, the target area, is 45% complete, and the second phase, the beam lines to the detector building, is 38% complete. The progress of the work can be seen in Fig. 7.

3. Neutrino Laboratory. Figure 8 shows the railroad tunnel into the target area. This phase of the work is 43% complete. Forming work is beginning

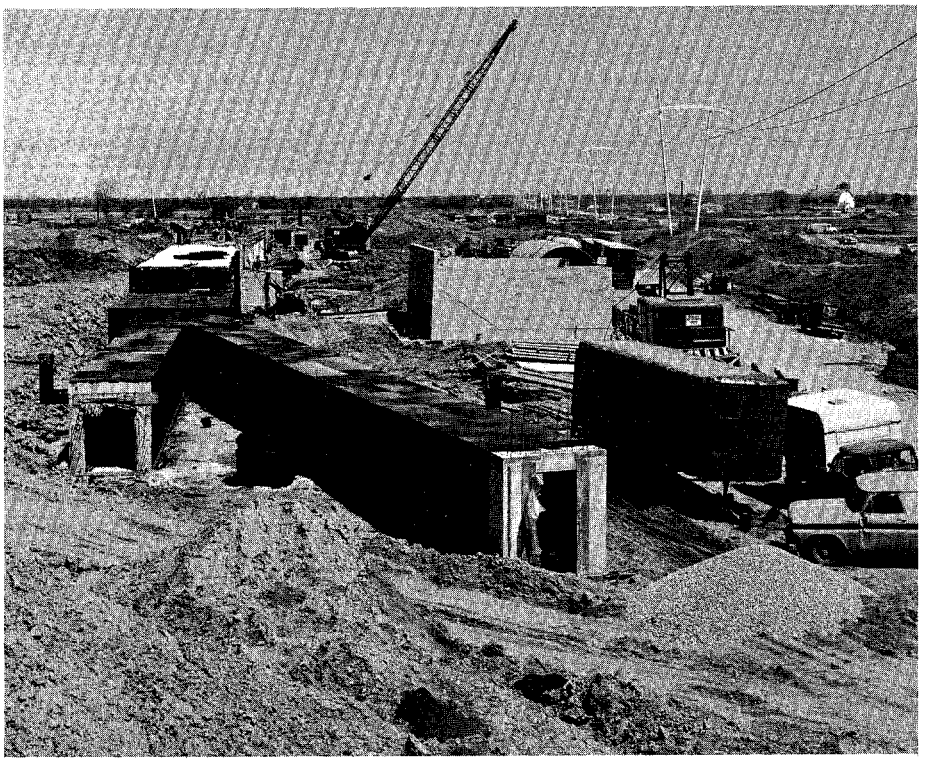

Fig. 7. The Meson Laboratory, looking downstream toward the target area. Road A is at the right.

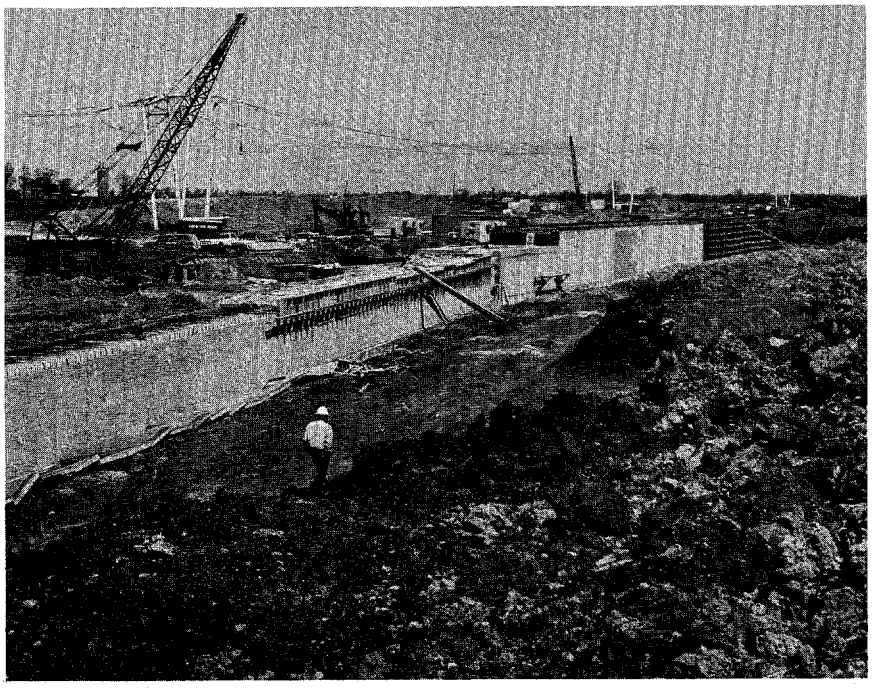

Fig. 8. The target area of the Neutrino Laboratory. The nearest structure is the railroad tunnel.

on Building A, at the far end of the area. The bubble-chamber foundation is also also progressing, as we see in Fig. 9. The second phase is 19% complete.

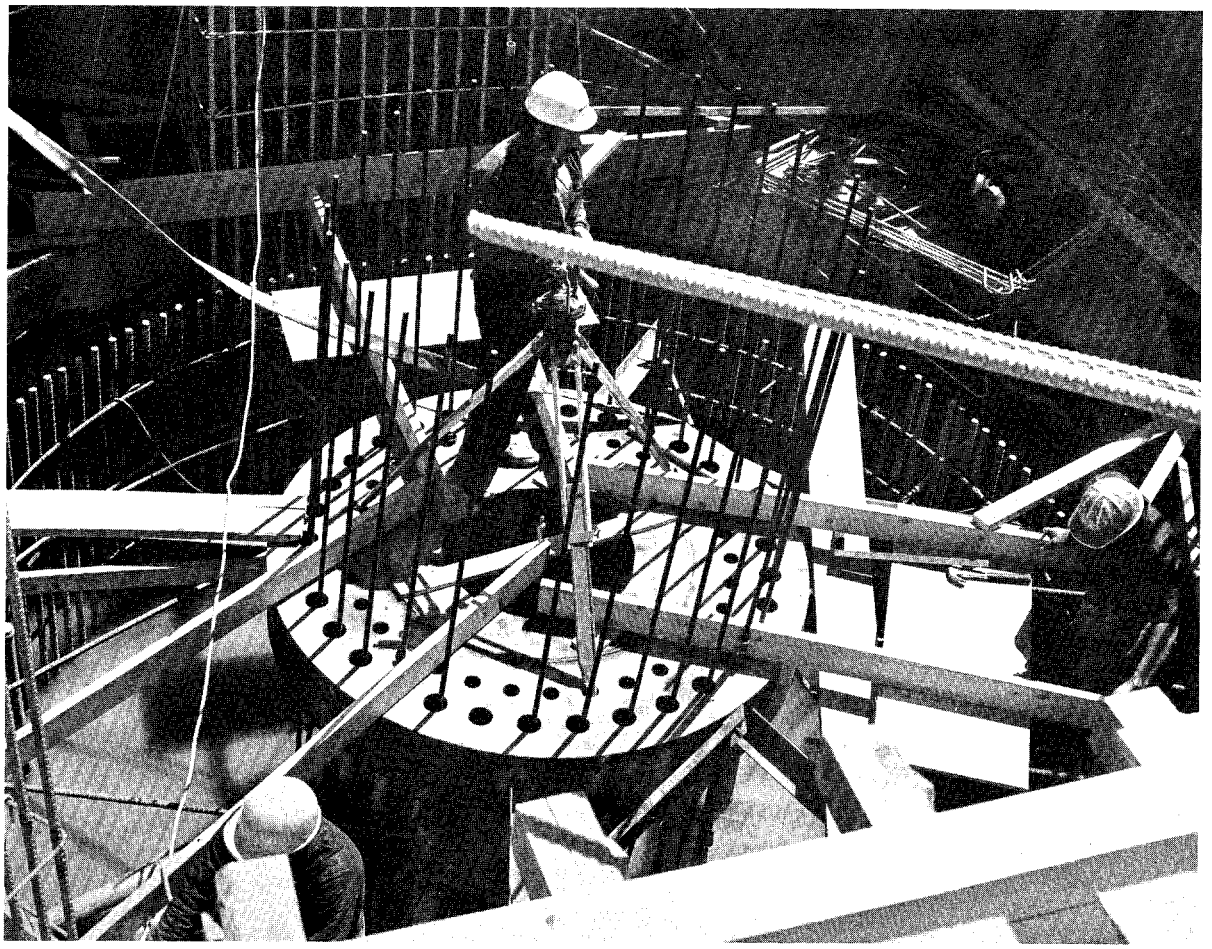

Fig. 9. Work on the foundation for the 15-foot bubble chamber.

The third phase, which covers the major part of the length between the target and detector areas, is just beginning. The greatest accomplishment has been the draining of Lake Rohrer, water that has stood for several years near the junction of Batavia Road and Road A.

4. Central Laboratory. Placing of the roof slab of the first phase, the ground floor, has begun, as shown in Fig. 10. Forming of the external columns is also starting. This contract is 51% complete.

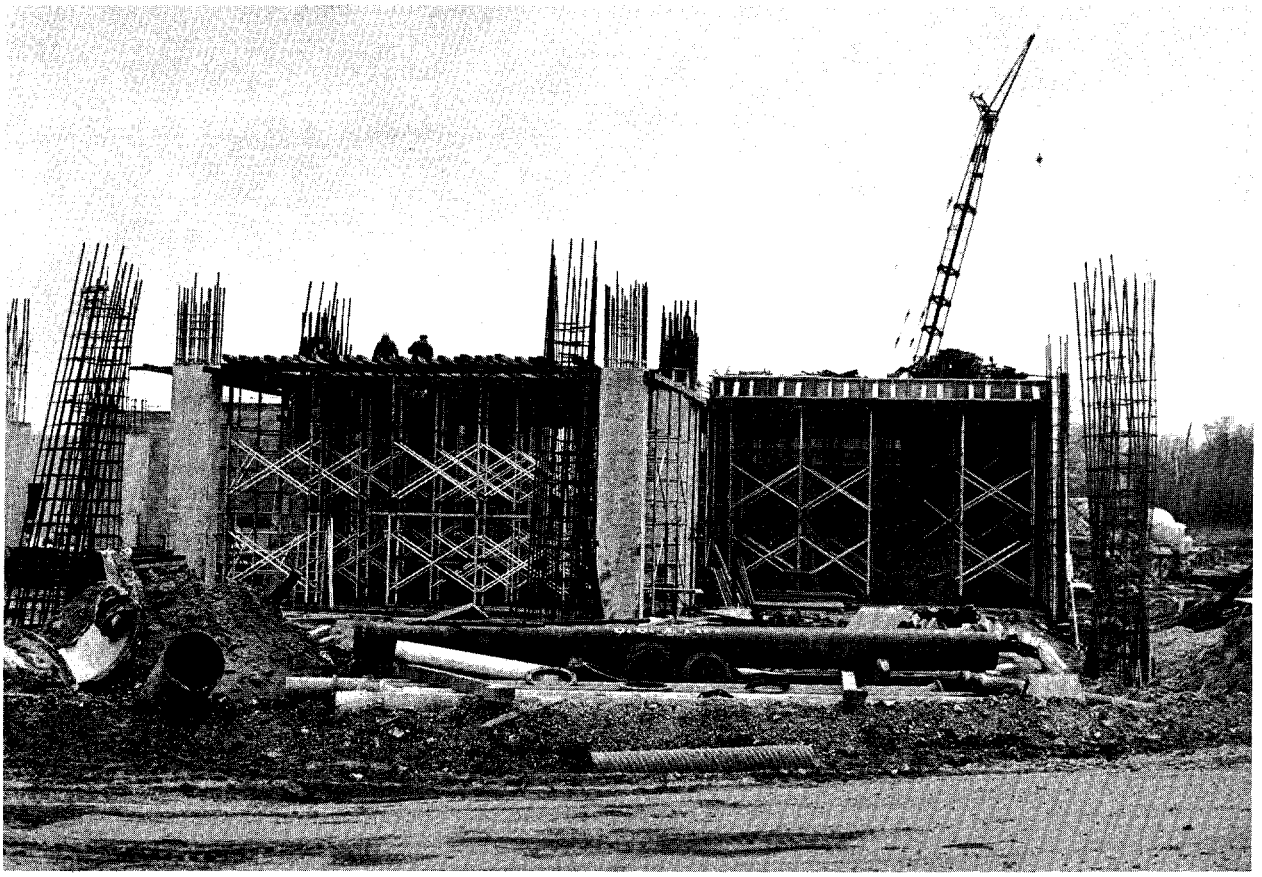

Fig. 10. Progress on the first phase of the Central Laboratory, viewed from the Transfer Gallery.

APPENDIX. ADDITIONAL PROPOSALS RECEIVED

115. Search for Long-Lived Particles ($\tau \gtrsim 0.1$ msec)

M. L. Stevenson

116. Interaction of High Energy Protons in Nuclear Emulsions Loaded with B^{10} and LiF

J. Casas, F. Fernandez, V. Gandia, P. M. Patel, A. J. M. Van Ginneken, H. Areti, C. J. D. Hebert, J. Hebert, P. Cuer, R. Kaiser, J. P. Massue, R. Schmitt, and A. Key

117. Phenomenological Study of 200 and 500 GeV/c Proton-Proton Collisions in Emulsion

S. Ozaki, O. Kusumoto, T. Teranaka, K. Watanabe, S. Kaneko, and S. Mikamo

118. Hadron Spectra from High Energy Interactions

L. Guerriero, R. E. Lanou, J. Massimo, J. I. Freidman, H. W. Kendall, L. Rosenson, and A. E. Brenner

119. Production of Heavy and Super-Heavy Nuclei in Targets Irradiated by Very High Energy Protons

120. Early π^{o} Particle Production Survey with the Gas Jet Target

C. Rubbia, J. Pilcher, D. Cline, and R. Imlay

121. A Proposal to Search for Very Heavy Strange Particles Using a Small Hydrogen Bubble Chamber

W. Ko, R. Lander, P. Yager, and J. Erwin

122. On Investigation of Neutrino Interaction in 14-Foot Bubble Chamber at NAL Accelerator

A. A. Volkov, P. F. Ermolov, V. I. Kurbakov, A. I. Mukhin, and V. N. Folomeshkin

123. Proposal for a Search for Quark-Matter at NAL

T. K. E. Alvager, J. B. Westgard, W. J. Beam, and Y. S. Kim

124. The Nature of the Momentum Spectrum of the Secondary Particles from High-Energy Collision

H. H. Aly

125. Proposal to Study π^-p Reactions at 60 and 200 GeV/c in the 30-Inch Hydrogen Bubble Chamber at NAL

T. Besliu, K. Bockmann, R. Campbell, V. T. Cocconi, P. Dalpiaz-Ferreti, P. Duinker, G. Kellner, W. Kittel, D. R. O. Morrison, H. Schiller, D. Sotiriou, R. Stroynowski, H. Wahl, and B. Whittaker

126. NAL Bubble Chamber Proposal Multiparticle π^-p Interactions at 130 GeV and at the Highest Energy

V. E. Barnes, D. D. Carmony, R. S. Christian, E. C. Fowler, J. A. Gaidos, A. F. Garfinkel, L. J. Gutay, S. Lichtman, F. J. Loeffler, R. L. McIlwain, D. H. Miller, T. R. Palfrey, Jr., R. B. Willmann, D. Cords, J. Lamsa, K. Paler, K. Rangan, and J. H. Scharenguivel

127. A Proposal to Study Slow Secondary Particle Distributions in π^- and pp Reactions in the 30-Inch Bubble Chamber

B. Eisenstein, G. Ascoli, R. Brown, L. Eisenstein, J. D. Hansen, U. Kruse, and R. Sard

128. Search for Mossbauer Type Nuclear Collisions with High Energy Protons

A. Benvenutti, D. Cline, and D. D. Reeder

129. An Investigation of the Components of the Neutral Beam Produced by High Energy Protons at NAL Using the 30-Inch Bubble Chamber

A. Benvenutti, U. Camerini, W. F. Fry, R. March, and D. D. Reeder

130. Proposal to Study pp Interactions Up to 500 GeV/c with the 30-Inch Bubble Chamber

R. Panvini, W. Sims, J. Waters, M. Webster, and A. Weinberg

131. NAL Bubble Chamber Proposal K^-p and $\bar{p}$p Interactions at 200 GeV

V. E. Barnes, D. D. Carmony, R. S. Christian, E. C. Fowler, J. A. Gaidos, A. F. Garfinkel, L. J. Gutay, S. Lichtman, F. J. Loeffler, R. L. McIlwain, D. H. Miller, T. R. Palfrey, R. B. Willmann, D. Cords, J. Lamsa, K. Paler, K. Rangan, and J. H. Scharenguivel

132. A General Survey of Pion-Proton and Proton-Proton Collisions in the 100-500 GeV/c Region

D. G. Fong, A. M. Shapiro, M. Widgott, G. Ascoli, B. Eisenstein, L. Eisenstein, J. D. Hansen, U. Kruse, R. Sard, R. A. Burnstein, L. Fu, H. A. Rubin, V. R. Veirs, E. D. Alyea, K. F. Galloway, H. J. Martin, J. E. Mott, R. E. Mercer, A. Pevsner, C. Chien,

(authors continued)

D. Denegri, R. A. Zdanis, B. T. Feld, B. Haber, R. Hulsizer, V. Kistiakowsky, I. A. Pless, F. Triantis, J. Wolfson, R. K. Yamamoto, N. N. Biswas, N. M. Cason, V. P. Kenney, W. D. Shephard, D. W. Thomas, R. J. Plano, D. Pandoulas, E. Brucker, E. L. Koller, S. Taylor, H. Kraybill, H. Taft, T. Ludlam, and D. Bogert