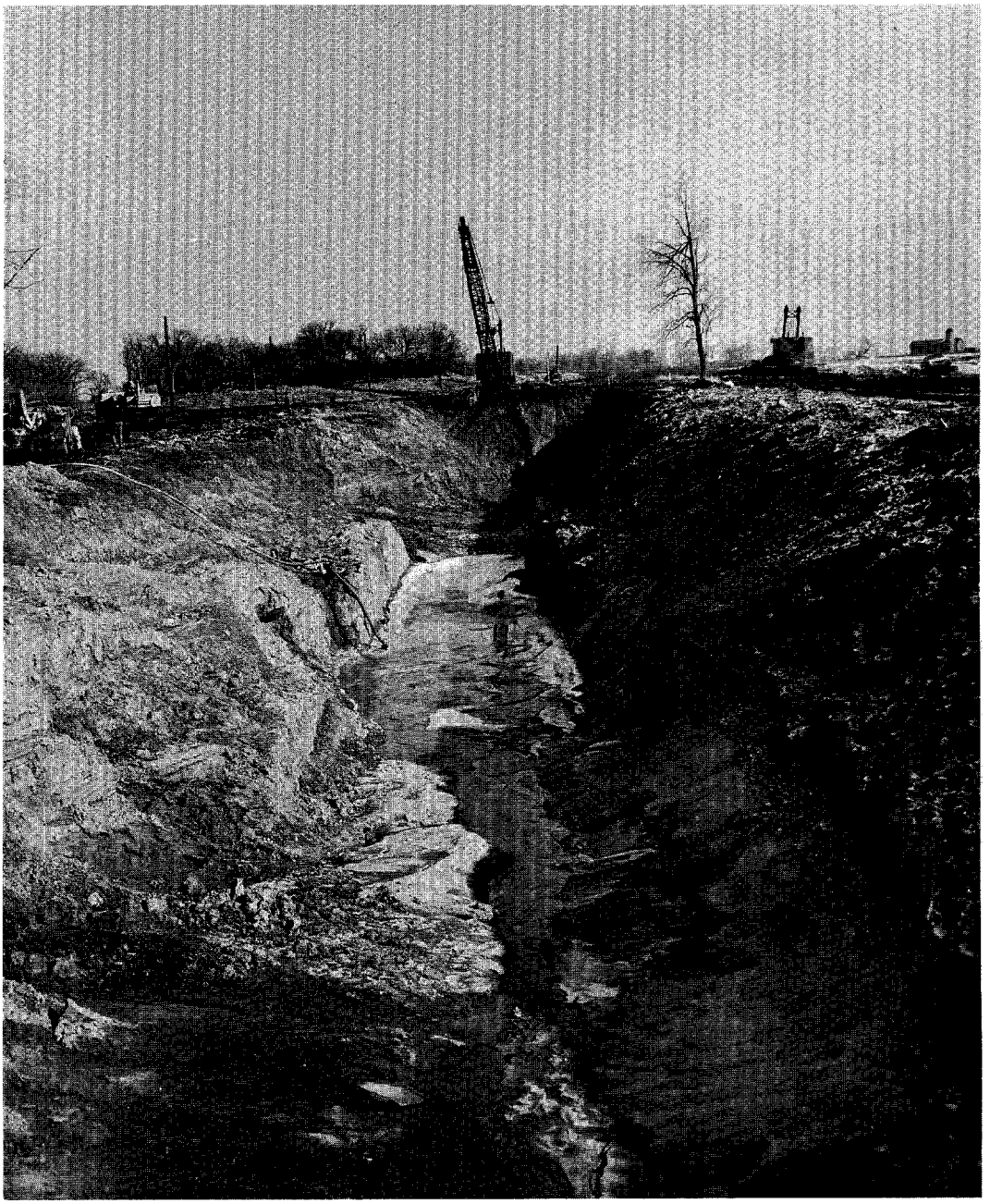
national accelerator laboratory FERMILAB-NAL-034

MONTHLY REPORT OF ACTIVITIES

November 30, 1969



EXCAVATION FOR THE MAIN ACCELERATOR

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

The cover is a photograph of the excavation for the main-accelerator tunnel taken November 21. The view is toward the north; the Transfer Hall excavation (Fig. 4) is just behind the camera. In the distance at the right is the site of the Industrial Buildings; the same barn is seen in Fig. 5.

MONTHLY REPORT OF ACTIVITIES

F. T. Cole

November 30, 1969

Abstract. This report summarizes the activities of the National Accelerator Laboratory in November, 1969.

General

1. Appointments. Alfred E. Brenner will join the Laboratory staff; he will be head of the Computer Group of the Experimental Facilities Section.

William B. Fowler will join the Laboratory staff; he will be head of the Bubble Chamber Group of the Experimental Facilities Section.

William M. Riches has been appointed Plant Manager. In this capacity, he will be responsible for operation of buildings and utilities.

2. Funding. The Laboratory received $9.9 million in construction funds in the month of November. The House and Senate of the Congress passed appropriation bills of $64 million and $89 million, respectively, for fiscal-year 1970. The conference committee compromised on $70 million (we would have preferred a mean-squared average). Although this is far short of the $102 million of our Design Report, we are still sticking to our schedule of a 200-GeV proton beam by June 30, 1972.

3. Construction Progress.

a. Linac Building. Most of the building is closed in and finishing work is proceeding inside. The contract is 93% complete. Figure 1 is a recent photograph of the work. Particular stress is being put on finishing the electrical shielding in the preaccelerator pit, in order to proceed with

installation - the crates containing the high-voltage power supply are taking up valuable parking space in the Village.

b. Booster. The tunnel is now finished, as can be seen in Fig. 2. The entire contract is 60% complete.

c. Cross Gallery. Figure 3 shows the progress in the forming and concrete work, which has now reached ground level. The contract is 38% complete.

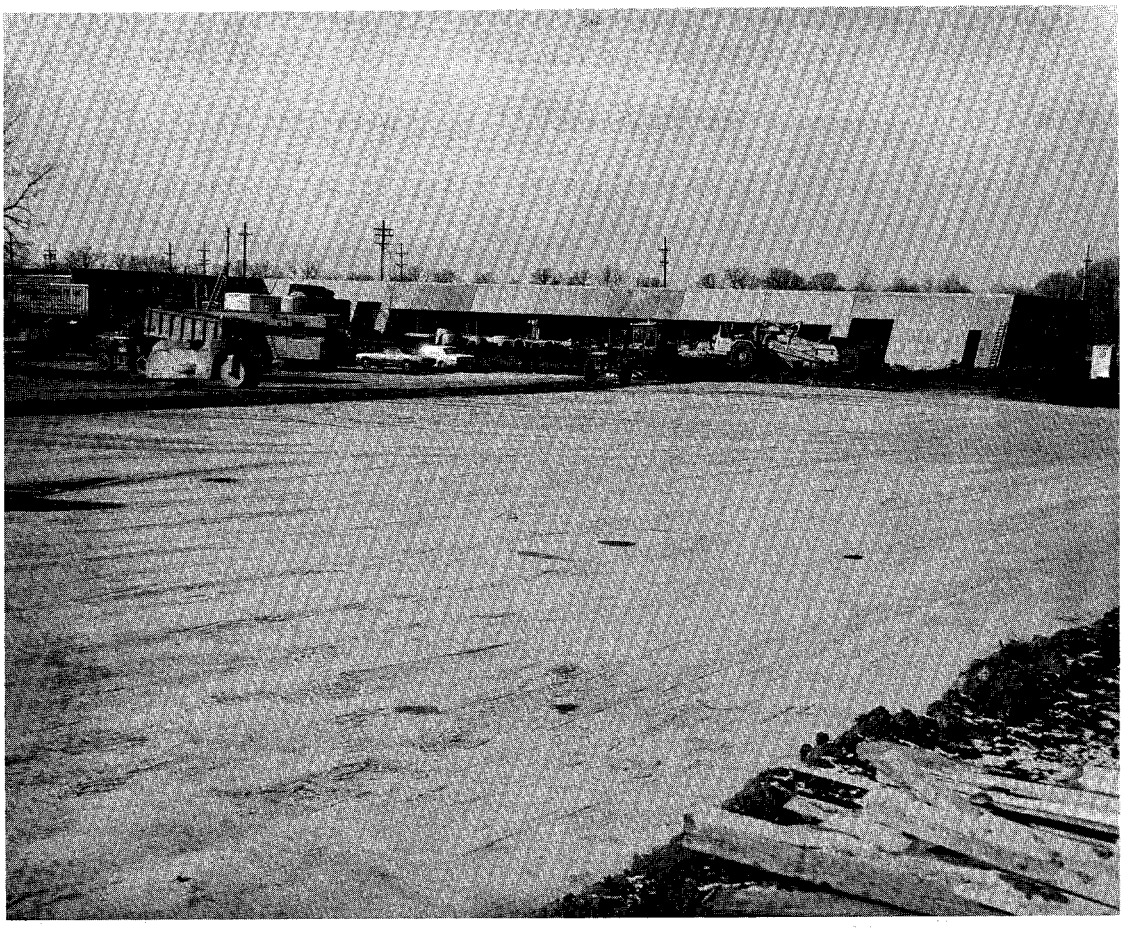


Fig. 1. The Linac Building. The photograph was taken from what will be the front of the Central Laboratory. Grading work in the footprint area can be seen in the foreground.

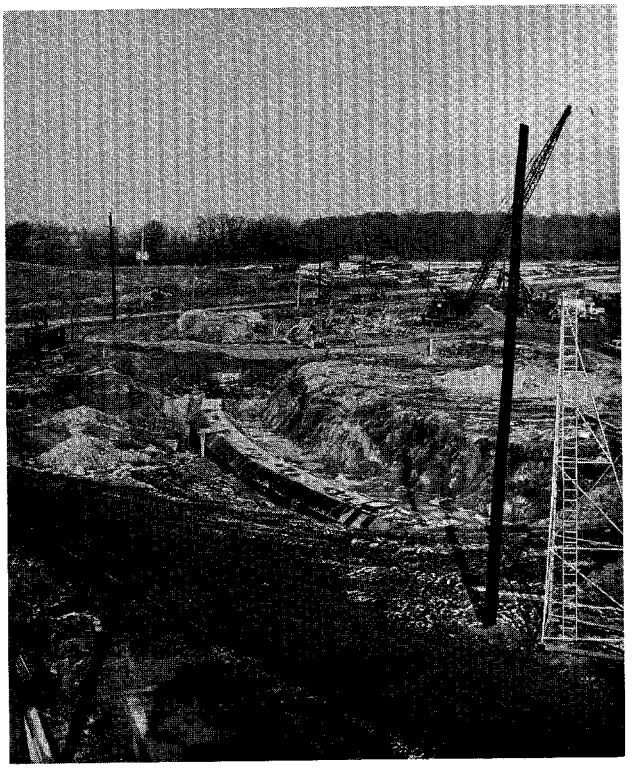


Fig. 2. The Booster Enclosure
This photograph was taken from almost the same position as Fig. 1 of last month's report. Just to the left of the crane can be seen some of the wiring and piping conduits that will run between the tunnel and the Booster Gallery above it.

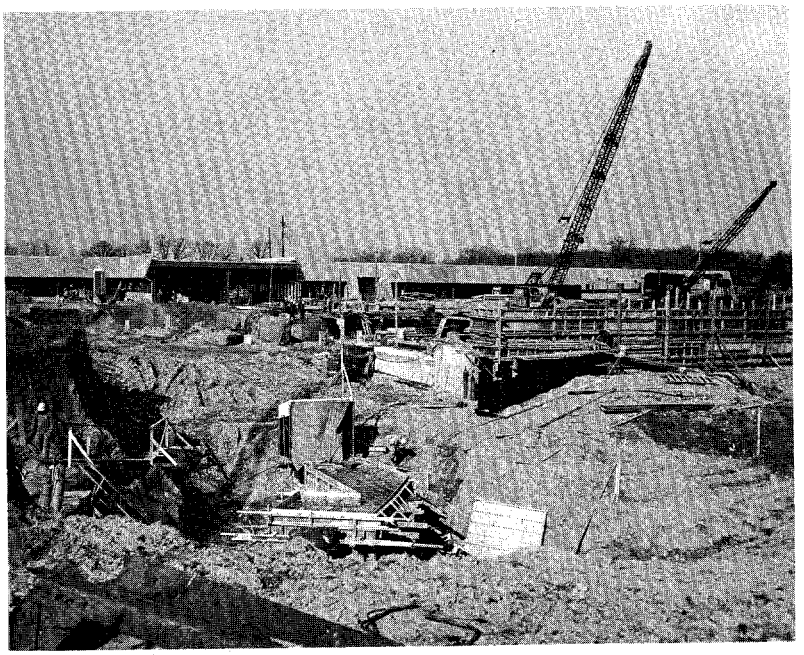


Fig. 3. The Cross Gallery. The Booster Tunnel is at the left, with the 8-GeV Transfer Tunnel in the foreground.

d. Main Accelerator (Phase I). Excavation work on the Transfer Hall and the tunnel is now well along, as can be seen in Fig. 4 and on the cover. The contract is 8% complete.

e. Industrial Buildings. Footings are well along, as can be seen in Fig. 5. The contract is 11% complete.

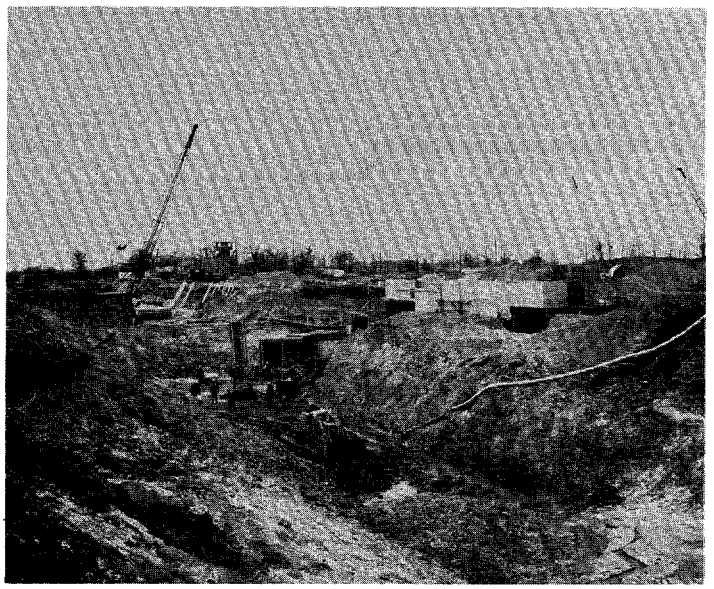


Fig. 4. The Transfer Hall excavation, looking south from the same point as the cover photograph. The Cross Gallery is to the right.

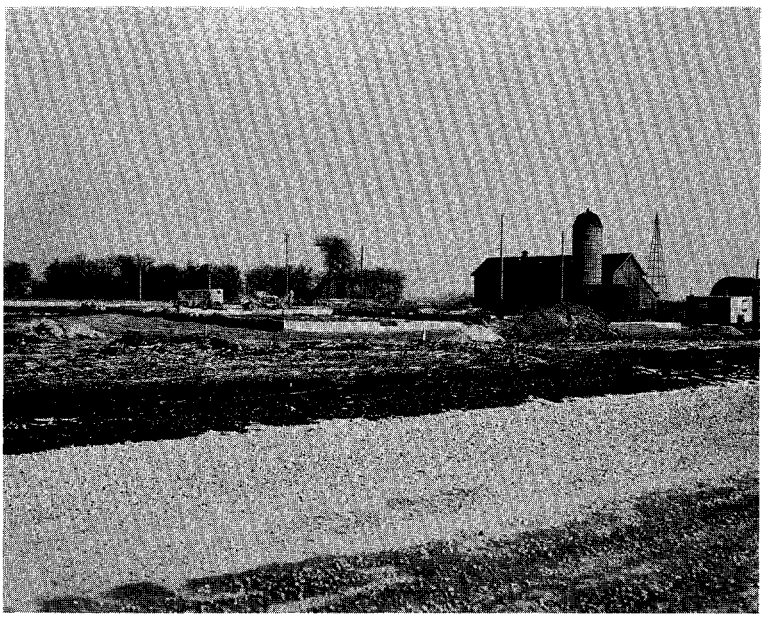


Fig. 5. Foundation work on the Industrial Buildings.

4. Experimental Facilities Workshop. The workshop on spectrometers will be held, as announced in last month's report, on December 12 at 10 a.m. at the Laboratory. Interested physicists are invited to participate.

5. Final Weston Meeting. The trustees of the Village of Weston held their final meeting in the Curia on November 26. The scene is shown in Fig. 6. At this time, they voted to dissolve the village, turned their remaining funds over to the West Chicago school districts, and presented their charter and other effects to the Laboratory for our museum.

Fig. 6. Final meeting of the Village Board of Weston. Seated from left to right are Village President Arthur Theriault, Trustees Robert Cook, Kenneth Urbanski, and Robert Peterson, and Mrs. Paula Boylan, Village Clerk. Speaking is State Representative Lewis V. Morgan, Jr. of Wheaton, whose district included Weston. Mr. Morgan is Majority Leader of the State House of Representatives and co-chairman of the Illinois Commission on Atomic Energy. (This photograph courtesy of the Aurora Beacon - News.)

Linac

1. 10-MeV Prototype. The 10-MeV prototype is in the middle of an intensive period of beam studies. After this period, it will be moved to the permanent building.

Work on the ion source has resulted in more intense beams injected into the linac. Beams of 270 milliamperes with emittances of 16 cm-milliradians horizontally and 20 cm-milliradians vertically have been measured at the entrance to the linac. This beam is easily injected into the linac acceptance of 100 cm-milliradians in each dimension. Fig. 7 gives examples of the output of the emittance-measuring system for some cases of interest.

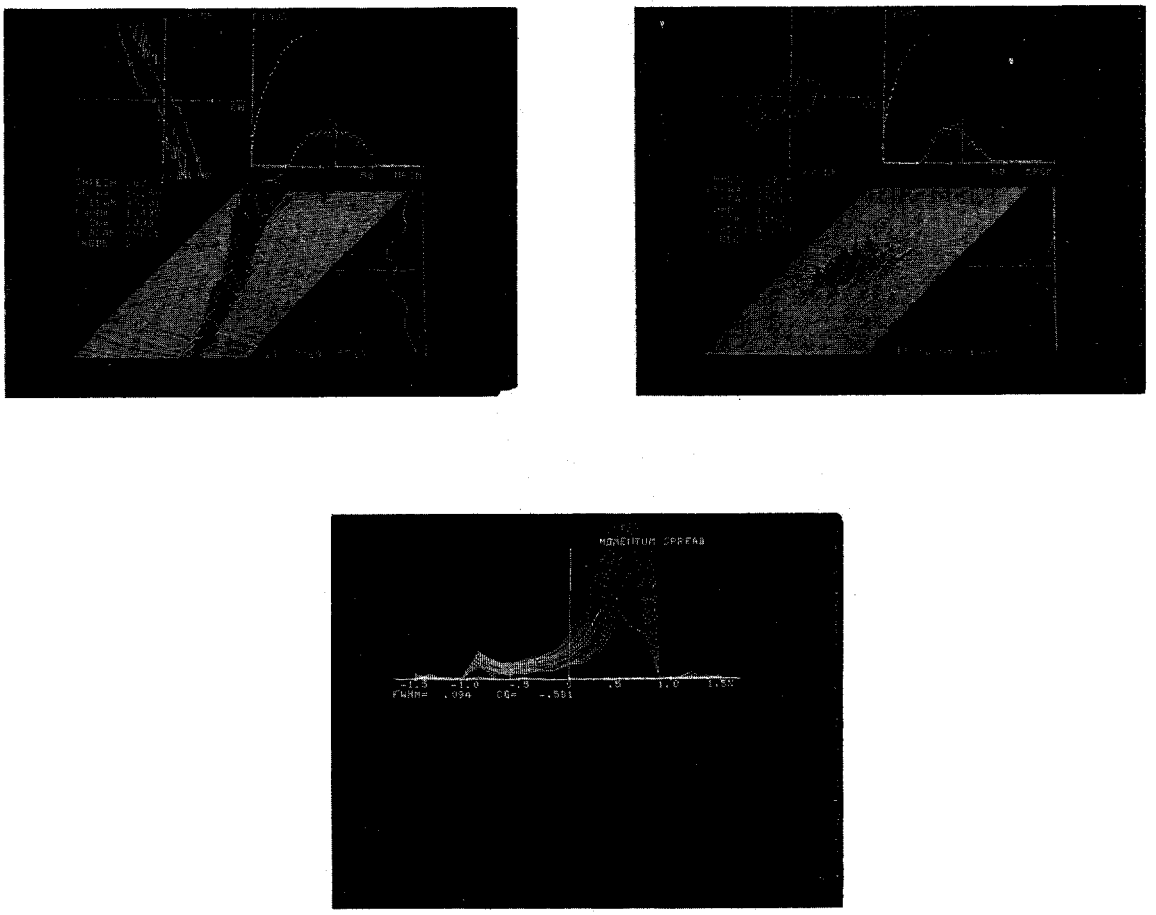


Fig. 7. Linac Beam Emittance Traces. Operating conditions are: 270 mA injected, 44 mA out at 10 MeV. buncher not in operation. The two upper photos are similar to those shown in the August monthly report. The first photo shows injected emittance, with 90% of the beam contained within 16 cm-mrad. The second photo shows emittance at 10 MeV, with 84% of the beam within 13-cm-mrad. The bottom photo is a plot of momentum spread. The total spread is seen to be about 2%.

The results on emittance of the 10-MeV proton beam are still preliminary. At this time, the focal properties appear to be about those expected from computation. There is some dilution; the emittance at 10 MeV is approximately three times larger than that expected from computation.

The total momentum spread for a 10-milliampere beam at 10 MeV is approximately 0.75% (for 95% of the beam) without the buncher being used. When the intensity is increased to 50 milliamperes, the momentum spread is doubled. All these results are being verified and studied further, but it does indicate that we shall be able to achieve the design current.

The Beam Transfer Section has installed a 1-foot model of a booster-extraction kicker magnet and an 8-GeV beam monitor at the 10-MeV end of the prototype to extend their previous bench tests.

2. 200-MeV Construction. Drift-tube fabrication is proceeding in the Linac Building in the Village. Machining of a drift-tube cap is shown in Fig. 8. All caps for tank 2 are now complete.

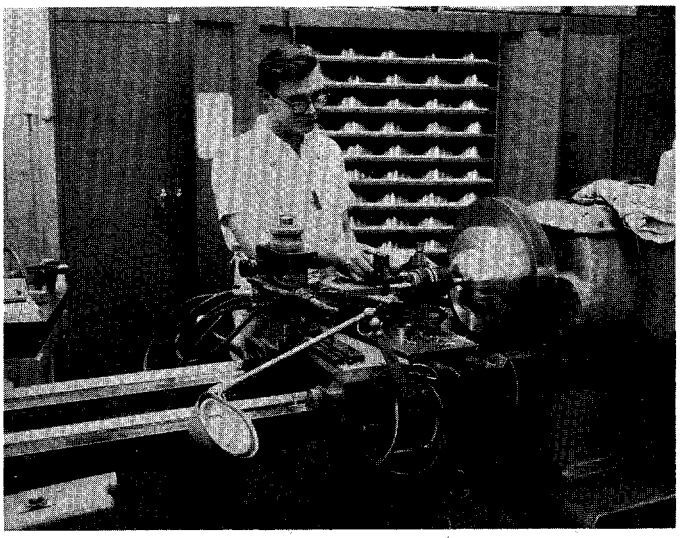


Fig. 8. Richard Gorski machining a drift-tube cap in the Linac Building. Finished caps are stored behind.

Some difficulties are being encountered in making satisfactory welds on tank 2 and delivery is expected in March, 1970. We expect that tank 3 will be delivered very shortly after tank 2.

Booster

1. Prototype. Prototype F and D magnets were delivered from the manufacturer and a second module has been completed and installed in the prototype. Tests were made of the power supply, particularly of the method of coupling cells. These tests were quite successful. The prototype magnets were also studied in detail and found to be within our tolerances. They appear from preliminary results to be satisfactory in meeting vacuum requirements. As a result, contracts have been negotiated with two manufacturers to produce 50 magnets each. We will also fabricate seven magnets of each type at the Laboratory.

2. Magnet End Shape. A modified D-magnet end shape has been produced and measured, following work in collaboration with the Accelerator Theory Section. The effective length is within 1 millimeter of the required distribution across the whole good-field region. It is planned that specification of the final end shapes will be completed early in December and that the first end packs will be available for magnet production in December.

3. 200-MeV Beam Transfer. The dc bending magnets and quadrupoles for the 200-MeV system to transfer the beam from the linac to the booster are now being fabricated. Design work is underway on the booster injection magnets.

4. External Magnets. The Booster Section is taking responsibility for the design and fabrication of the bending and focusing magnets of the external-beam line. In addition, members of the Booster Section are participating

in the conventional-magnet task force of the Experimental Facilities Section.

Main Accelerator

1. B1 and B2 Coils. Responsive bids on B1 and B2 outer coils have been received from eleven vendors. Evaluation of the vendors is now in progress. It is planned to let contracts with approximately four of these vendors in December.

2. Measurements on Prototype Steel. A prototype quantity of 100 tons of magnet steel has been tested for coercive force. The measurements show a two-peak distribution (one peak at about 0.95 and one peak at about 1.2 oersted). We are investigating this effect with the supplier.

3. Power and Water Distribution. The distribution system inside the tunnel has been redesigned to eliminate the large-diameter insulators in the water system. The new design has two 1.5-inch copper pipes for bending-magnet power and two 1.5-inch copper pipes for quadrupole power. Cooling water will be supplied by two 4-inch aluminum pipes which will serve as a safety ground and shield for the power buses.

Radio-Frequency

1. Prototype Booster System. Two prototype booster cavities are being fabricated. Figure 9 shows this work in progress. A power amplifier is now undergoing power tests and will shortly be installed in the booster prototype. A prototype modulator and power supply has been installed in the booster prototype and will be in operation when adequate cooling water is available.

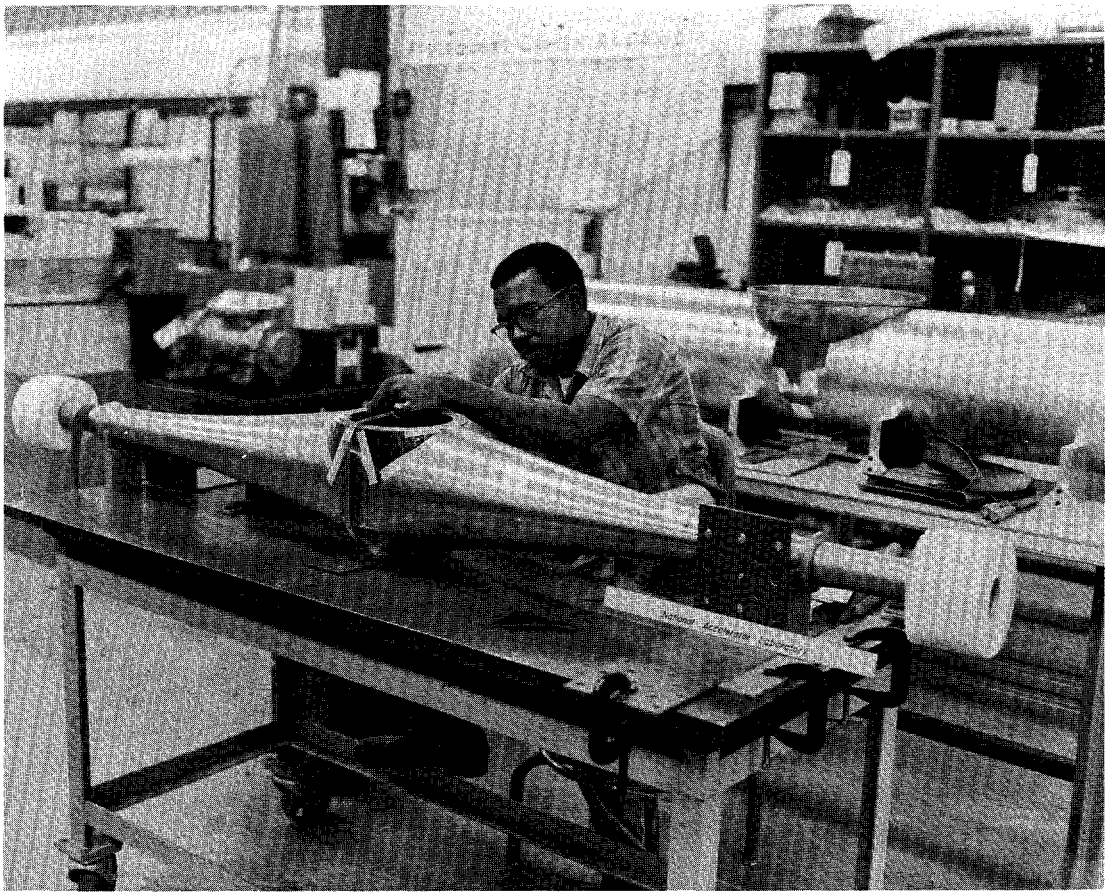


Fig. 9. Clinton Martin assembling the drift-tube section of a prototype booster cavity.