national accelerator laboratory

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MONTHLY REPORT OF ACTIVITIES

February 28, 1969

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F. T. Cole

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General

1. Booster Enclosure. Construction began February 26 on the booster enclosure with issuing of notice to proceed to the Herlihy Mid-Continent Company of Chicago, the low bidder.

2. Cross Gallery. Invitations to bid on the Cross Gallery have been issued and bids are to be returned March 6.

3. Construction Progress. Figures 1 through 4 are recent photographs showing progress on various construction projects.

In particular, the linac building, the largest project, is on schedule. Footings and concrete fill have been placed for the cavity enclosure and the preaccelerator pit and forms and reinforcing steel are now being placed for the floor slabs.

4. Technical Services. Henry Hinterberger has been named Director of Technical Services, a newly formed division. This division will manage machine shops, the model shop, specialty shops, a central drafting pool, as well as serve as a rallying point for general engineering efforts. Engineers will continue to be assigned to sections where they are directly responsible to the section head.

*This work was done under contract with the U. S. Atomic Energy Commission.

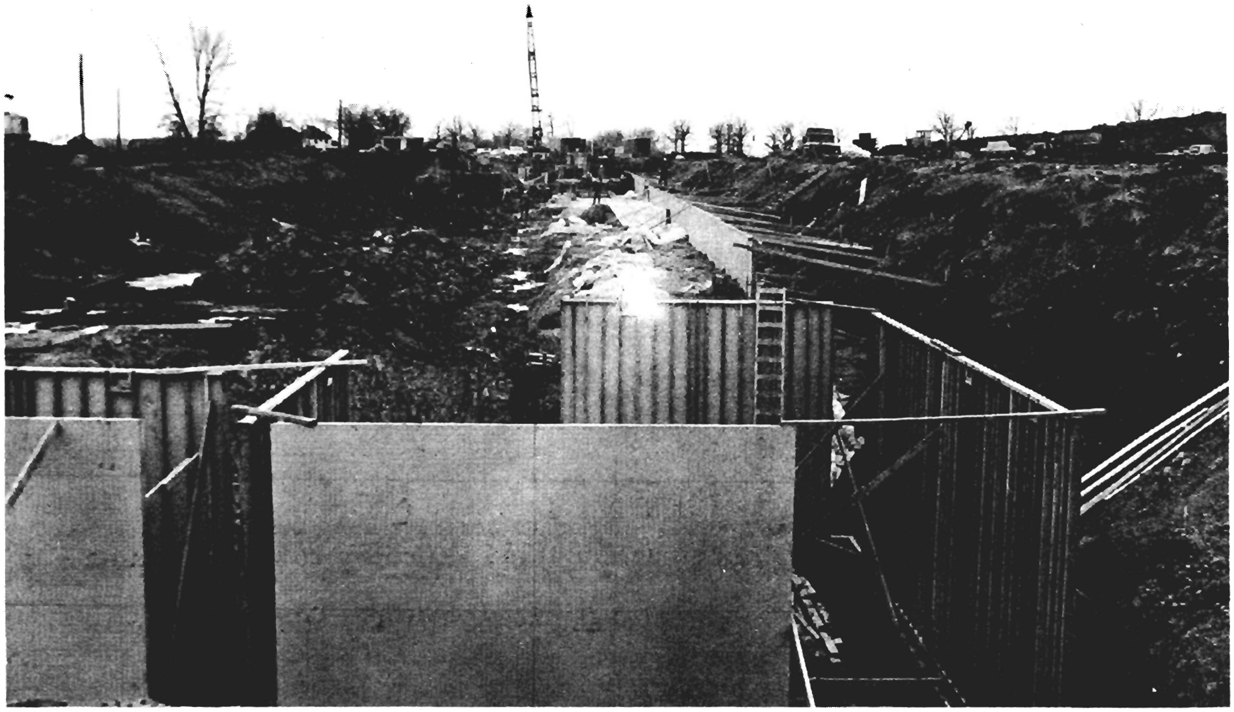

Fig. 1. The Linac Building site on February 26, looking southwest. Forms for the preaccelerator enclosure are in the foreground. The Booster Enclosure site is in the background, to the right of the farmhouse. Work on the rough-roads contract is proceeding at the extreme right of the photograph.

Fig. 2. The Main-Ring Enclosure Prototype, as of February 26.

Fig. 3. The Booster-Enclosure Prototype, as of February 26. The Booster Gallery is above the ring segment, closer than it will be in the actual building.

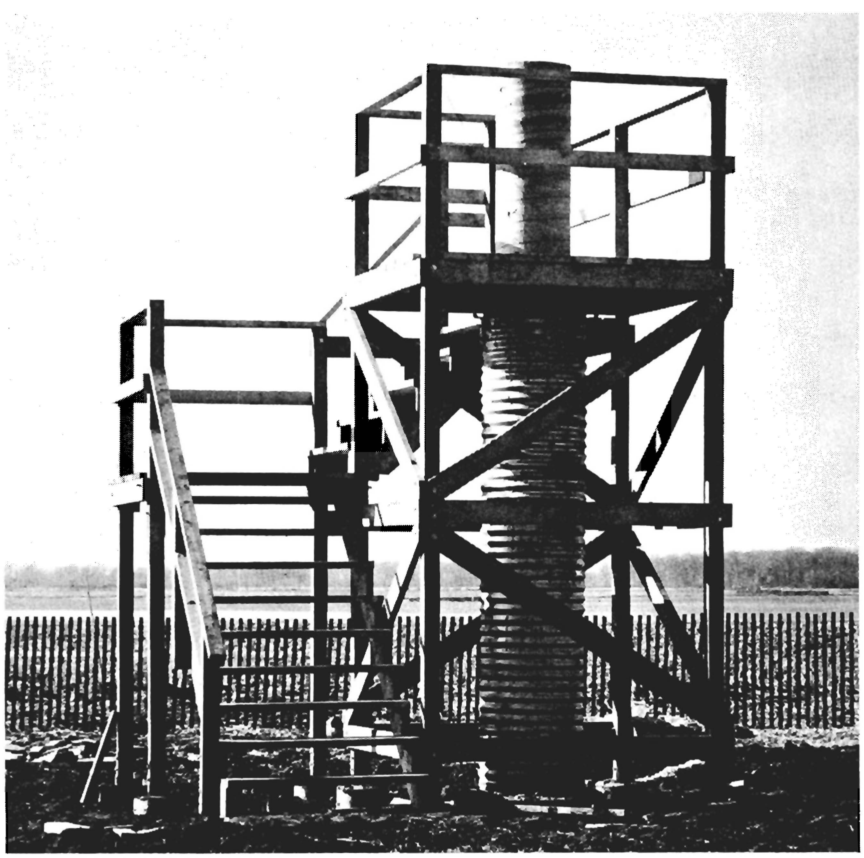

Fig. 4. A survey monument.

Accelerator Theory

1. Main-Ring and Booster Repetition Rates. A task team has studied cost and performance of several main-ring and booster cycling rates. For the booster, the results are that total cost is not a strong function of repetition rate below 15 Hz, but increases sharply above this frequency. Performance increases proportionally with repetition rate and the design frequency of 15 Hz therefore appears to be close to an optimum.

For the main ring, performance also increases with repetition rate, but the cost curves have no clear-cut break. It is therefore proposed that we consider a two-stage operation, in which all systems are designed for the Design Report 2.2 sec pulsing time (cycle period without flat-top less injection period), but with a preliminary operation at a longer pulsing time, say 4.2 sec, with fewer modules of the main-ring rf and magnet power-supply systems.

2. Longitudinal Space-Charge Effects at Transition. The problem of bunch-shape distortion at transition energy discussed in last month's report has been further investigated. The feedback damping system is found to act too slowly to prevent bunch-shape distortion just after transition, but does damp these distortions, so that some time after transition, the bunch is restored to the matched shape suitable for efficient extraction.

It should be pointed out that a feedback system using the same principle has been developed earlier and used with good results by E. C. Raka on the Brookhaven AGS.

Linac

1. Prototype RF System. The problems of grid emission in the modulator

tube have been overcome by use of a different tube. The modulator has been successfully tested at the fabricator's plant and is being prepared for shipments to the Laboratory. The power-amplifier cavity system has been received and is being installed.

2. Prototype Cavity. The 25-foot 10-MeV linac cavity was received on February 14. The cavity is now on its support and the drift-tube holes are being machined. Figure 5 shows the state of the work on the tank. Figure 6 shows a drift tube, complete except for welding of the end caps to the body.

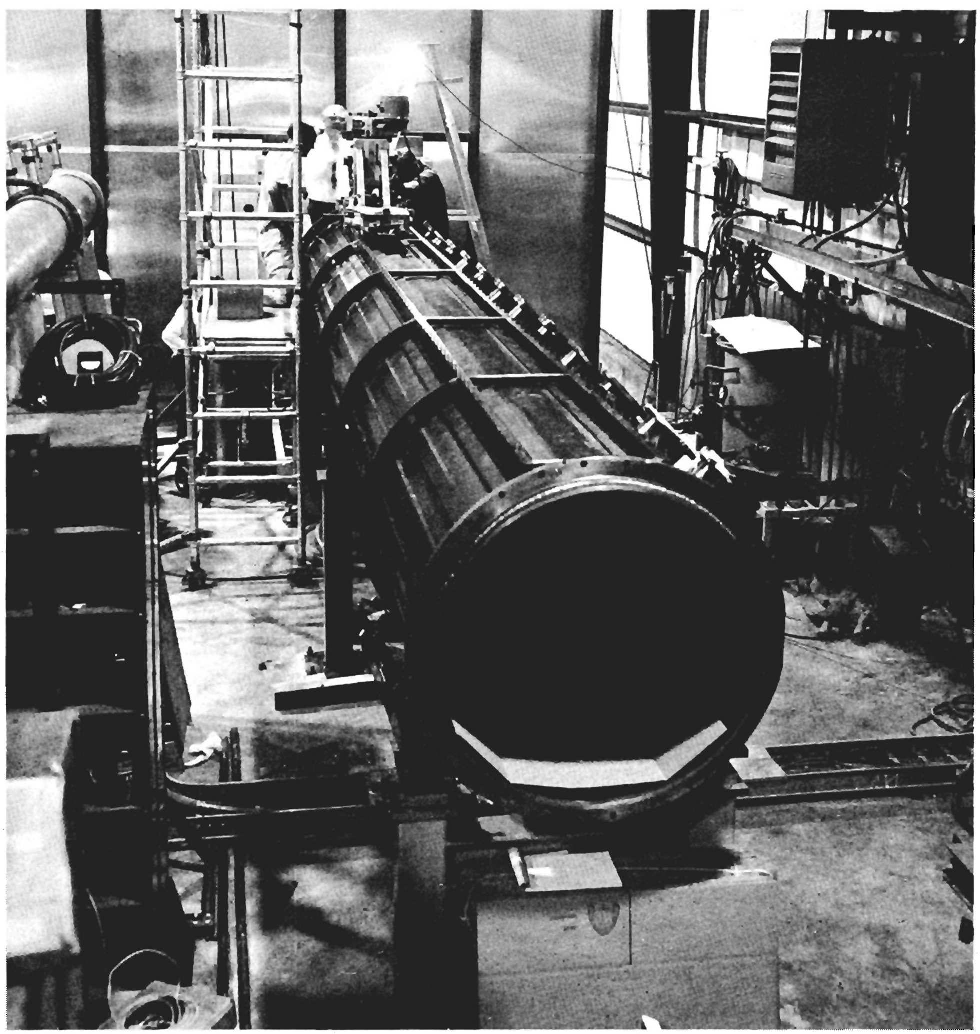

Fig. 5. The 10-MeV Prototype linac tank. Dwayne Leifheit, John O'Meara, and Richard Lepszky are at the low-energy end, working on machining drift-tube holes. The portable drilling rig can be seen in front of them.

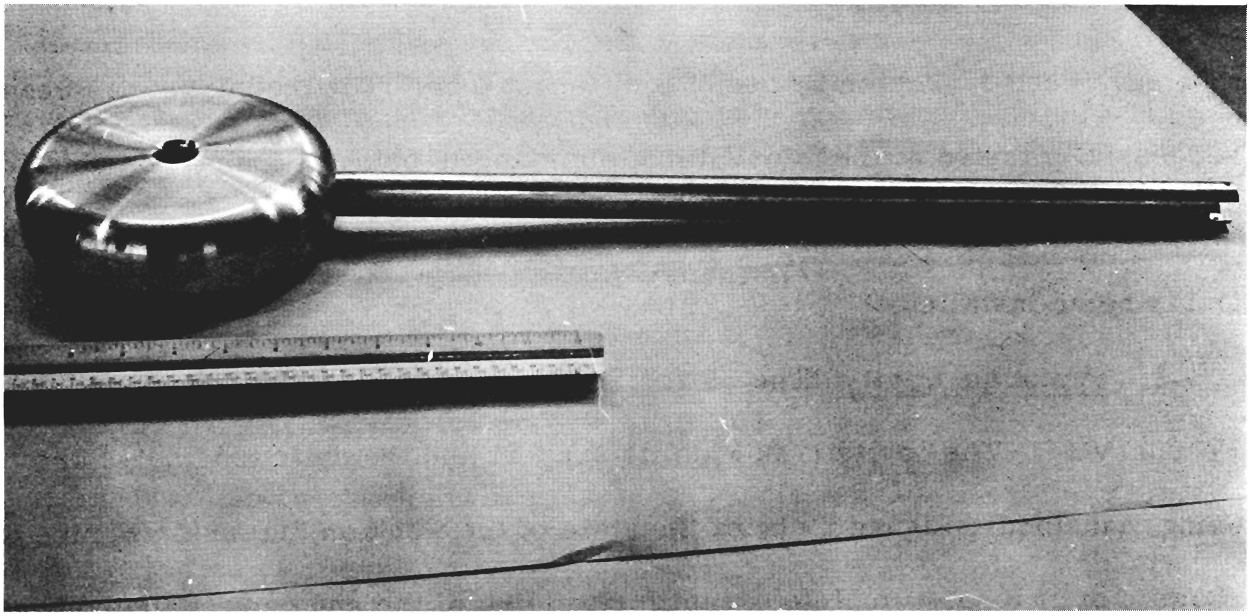

Fig. 6. A linac drift tube.

3. Preaccelerator. The accelerating column has been completely assembled and mounted in the preaccelerator enclosure. Voltage testing is now in progress. Figure 7 is a photograph of the column and pressure tank before assembly.

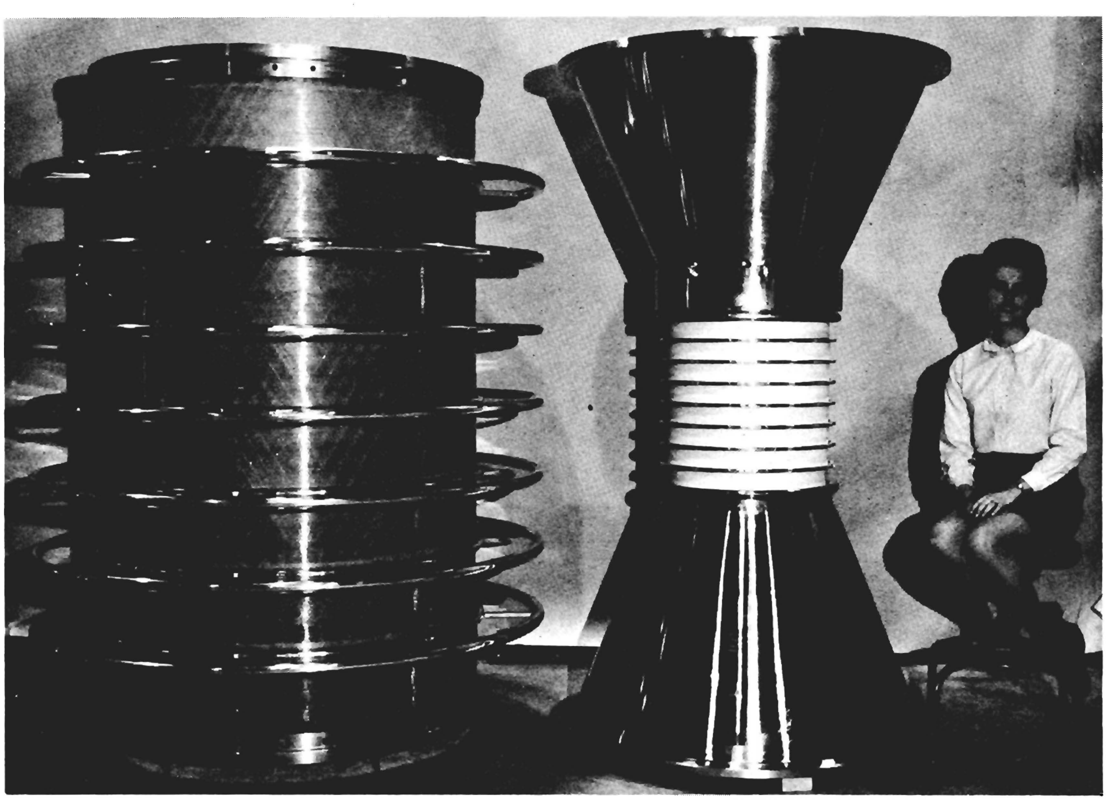

Fig. 7. The accelerating column and its pressure tank (to the left). Margaret Kasak is present to show the scale.

Booster

1. Magnet Program. The first heat-cured model magnet has now been completed. It shows that the proposed fabrication technique is feasible. In this technique, the stacked laminations and the coils are vacuum-impregnated simultaneously with a heat-cure resin in the stainless-steel vacuum envelope, as can be seen in Fig. 8. The magnet pole surfaces are kept free of resin by an inflatable rubber bag. The technique will be developed further in two development contracts with industry. In addition to these contracts, those for magnet dies, punching, steel, and conductor have all been placed for prototype quantities, with later options for the full quantities.

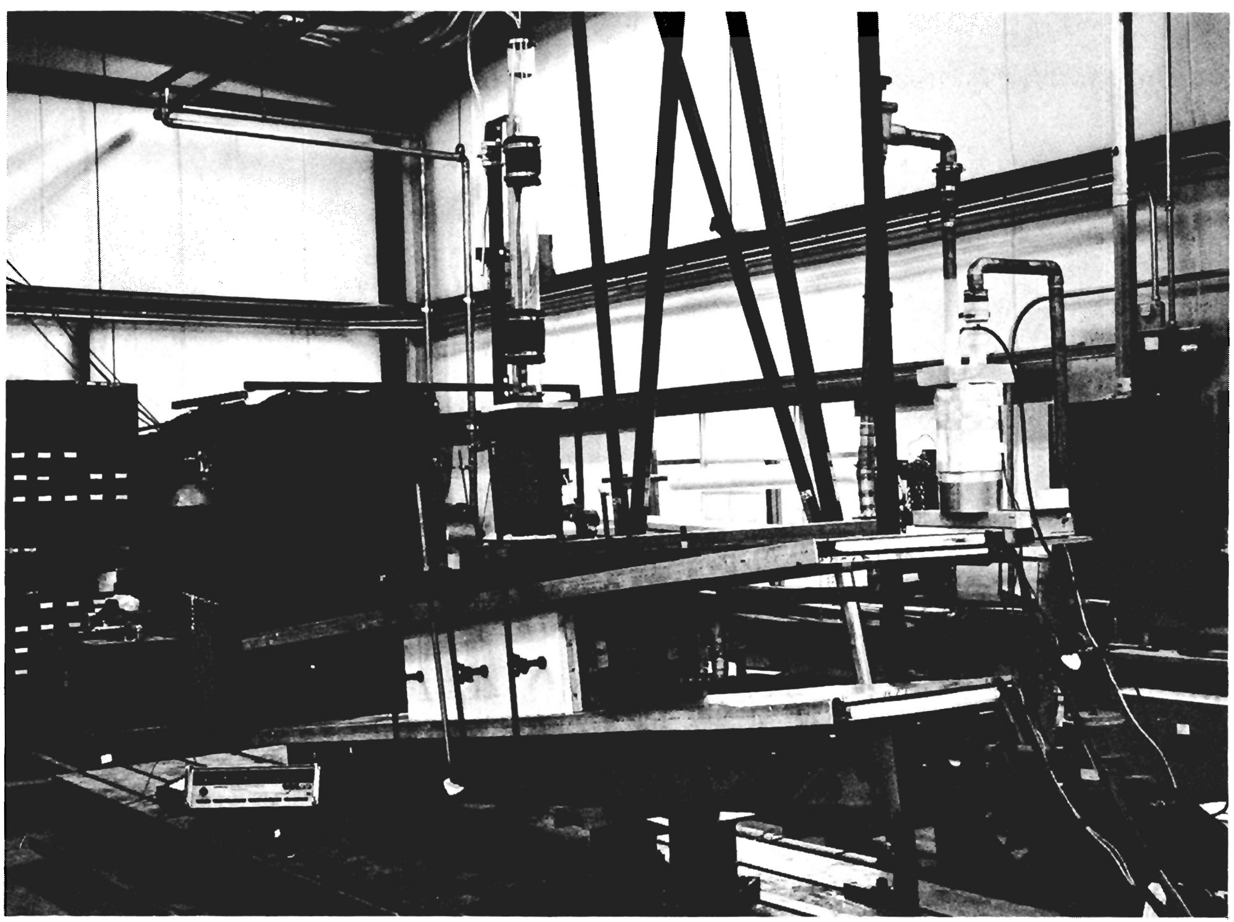

Fig. 8. Booster magnet during impregnation.

Main Ring

1. Crenellated Magnets. Crenellation tests have been made on a model magnet, using the scheme shown in Fig. 5-1 of the first printing of the Design Report. The field shape is independent of field level up to 21 kG and is improved by crenellation at 22 kG. But the field is perturbed at low fields by crenellations that extend to the pole surface. A uniform amount cut from the crenellated laminations to "bury" them below the surface should eliminate this problem.

2. Structural Model. The sag discussed in last month's report has been investigated further. The results show that it is a true sag, not a welding deformation. Further, the sag decreased when more shear plates were added on the sides. We believe that the sag is caused by shear in these plates.

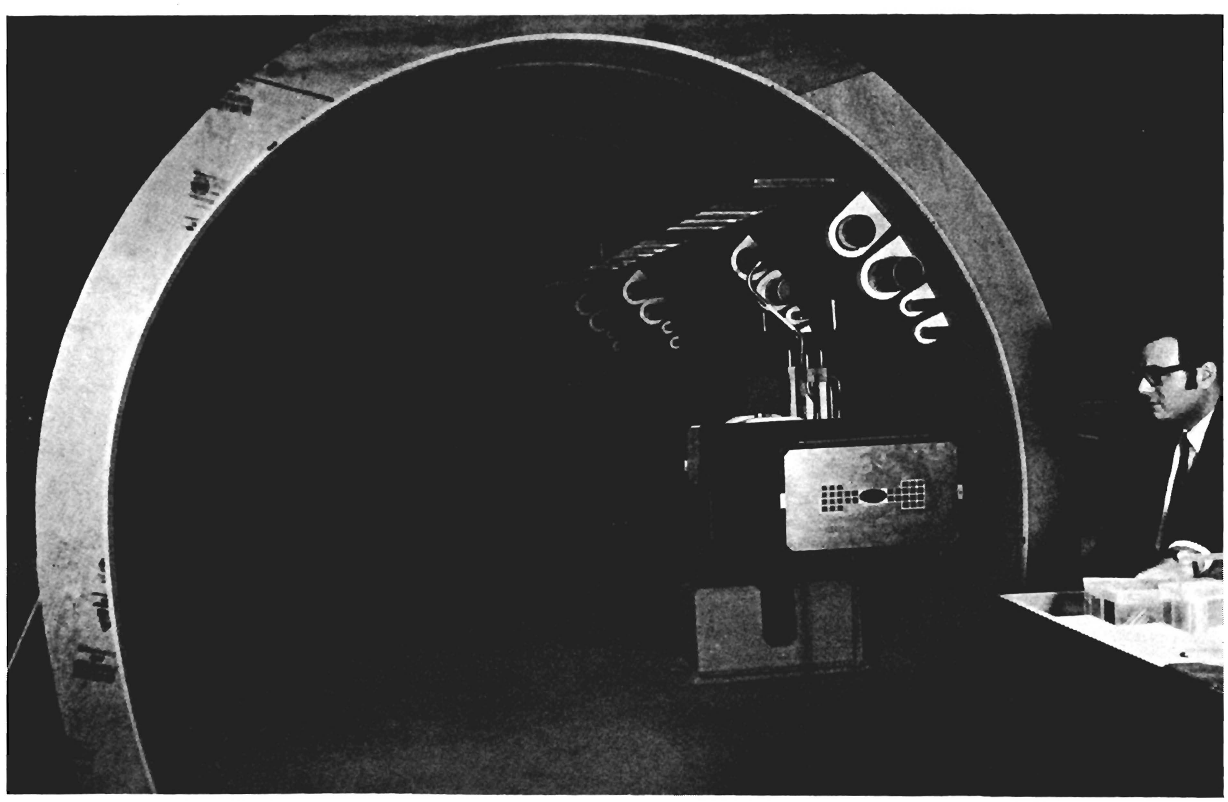

Fig. 9. Main-ring tunnel model. John Satti is at the right.

3. Tunnel Model. The main-ring tunnel model has been set up in the recently completed model shop. It is shown in Figs. 9 and 10.

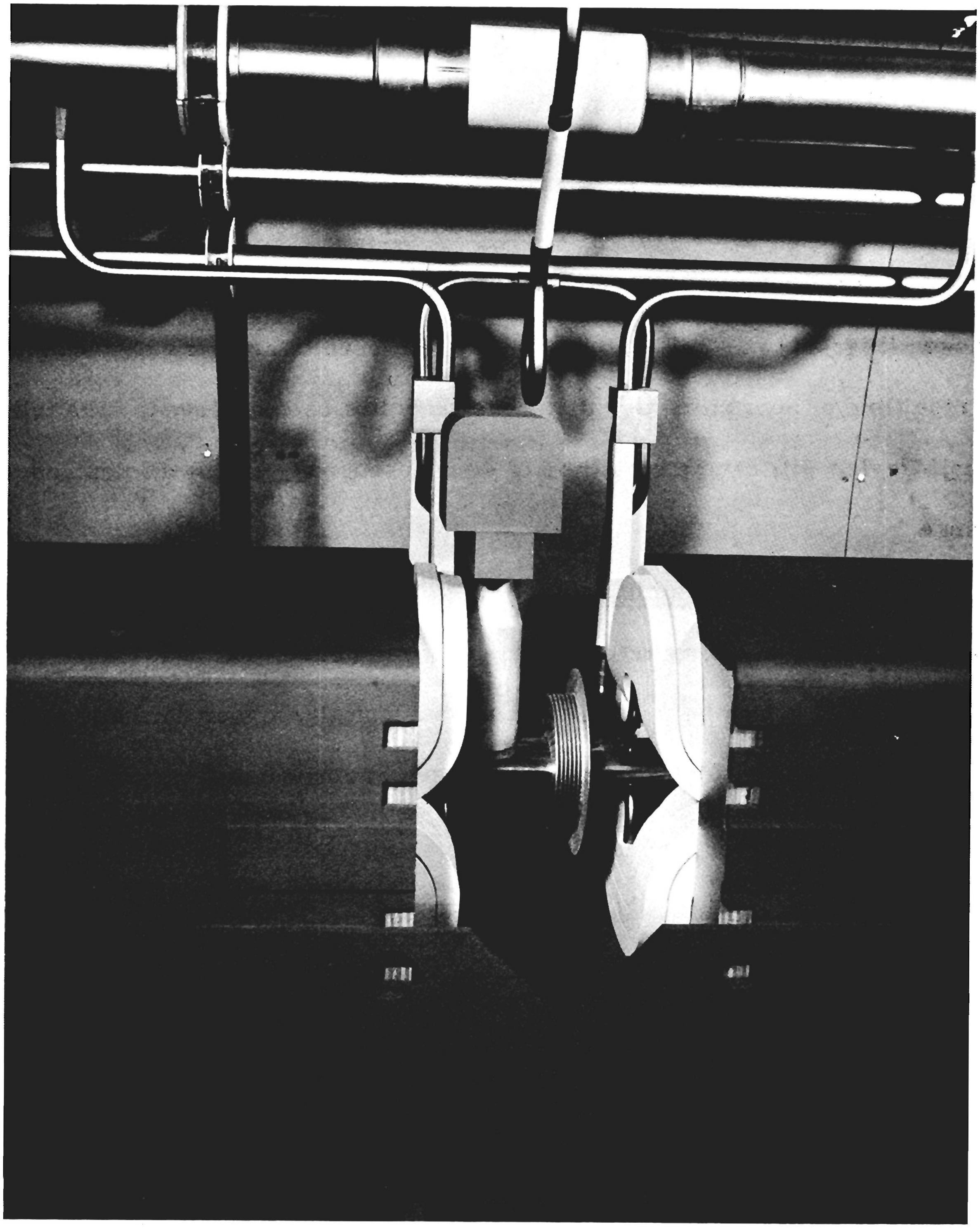

Fig. 10. Detail of the tunnel model. The space between magnets contains coil ends, vacuum flange, bellows, and pump (above the magnet) and power and water connections.

Radio Frequency

1. Booster Cavity. Orders have been placed for prototype quantities of ferrite and insulators.

2. Beam Pickup. A beam-pickup device of the type discussed in the Storage Ring Report has been assembled and tested, with good results.

Beam Transfer

1. Fast Kicker. A quarter-scale model of the booster-extraction fast kicker (Fig. 11) was pulsed this month. The results are very encouraging; a rise time of approximately 10 nanoseconds has been achieved. The full-scale device will have a rise time of 40 nanoseconds, within the desired design range.

2. Edge-Cooled Septum. A 2-foot model of the edge-cooled septum magnet (Fig. 12) is in operation. The operation indicates that heat transfer is working well; it may be possible to use substantially higher currents than originally planned. Magnetic measurements are now being carried out.

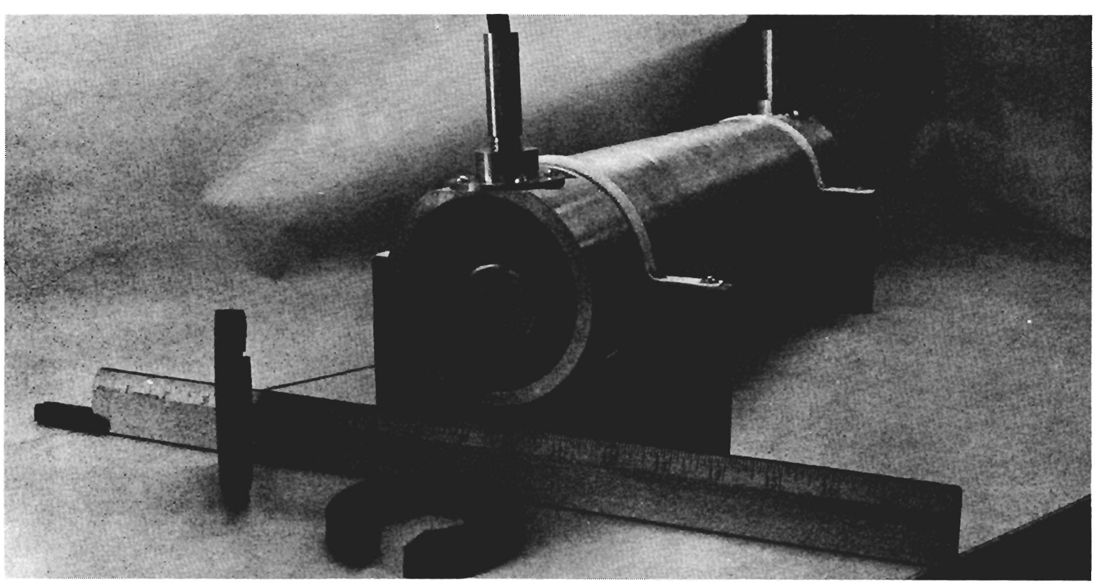

Fig. 11. Booster-extraction fast kicker, with extra "laminations" in front of the scale.

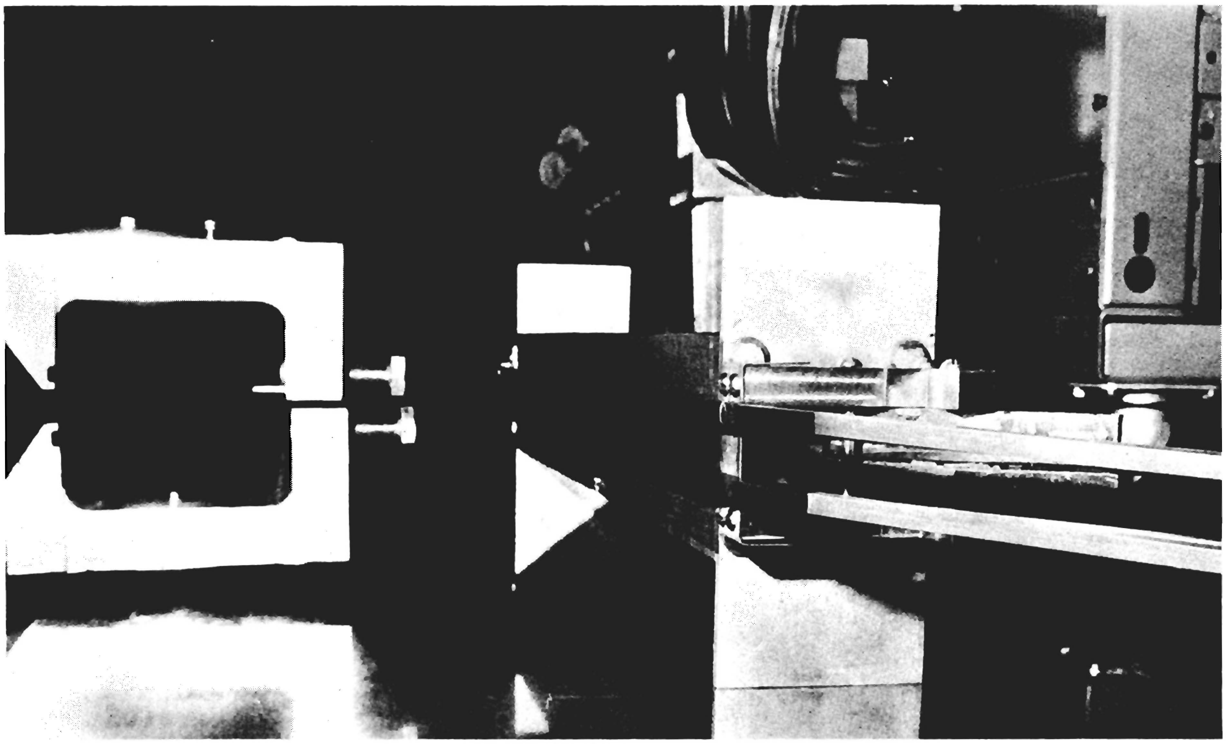

Fig. 12. Edge-cooled extraction septum magnet. The device to the left is a clamp that fits over the magnet to hold the cooling tubes in place.

Experimental Facilities

Research-Equipment Estimates. During the last several months, the staff attempted to make a zero-order projection of the expenditures of equipment funds required to implement the high-energy physics research program at the planned scope through FY 1975. A detailed cost estimate has been prepared.* The kinds and numbers of equipment items (beam transport, detectors, computers, and so on) were estimated by the Experimental-Facilities staff; most of the costs were estimated by W. M. Brobeck and Associates.** Through the end of FY 73, obligations are estimated to be $80 million and costs to be $56 million.

*E. J. Bleser and A. L. Read, NAL Memorandum MM-148.
**W. M. Brobeck and Associates Report 200-1-R7.

Fig. 13. Members of a Laboratory training group en route to Oak Ridge National Laboratory for training. These men will join NAL technical sections after their training. Ken Williams is fifth from the right in the back.

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