J. Orado

NAL-14
0090.01

national accelerator laboratory

# MONTHLY REPORT OF ACTIVITIES*

F. T. Cole

August 1, 1968

Abstract: This report covers the activities of the National Accelerator Laboratory for the month of July.

*This work was done under auspices of the United States Atomic Energy Commission.

national accelerator laboratory

national accelerator laboratory

# MONTHLY REPORT OF ACTIVITIES

F. T. Cole

August 1, 1968

## General

1. Status of Appropriation. The Senate passed on July 20, 1968, a bill containing a $20 million appropriation for NAL with authorization for construction. The subsequent House-Senate Conference Committee reported on a public-works bill containing a $12.074 million appropriation for NAL, with limited construction authorized. This bill was passed by the House on July 25 and by the Senate on July 30 and has been sent to the President.

The relevant portion of the bill is as follows:

> "AMENDMENT NO. 18. Appropriate $461,574,000 instead of $456,600,000 as proposed by the House and $469,500,000 as proposed by the Senate. The increase in the House bill amount is for the 200 BeV accelerator to be located in DuPage and Kane Counties, Illinois. The Bill provides a total for the project of $14,574,000 including available carry-over funds of $2,500,000. The amount provided is to be allocated as follows: Engineering and design, $8,674,000;

Land improvements, $700,000. Other structures (transfer hall, booster housing, linac housing), $5,000,000; and for temporary utilities related to the other structures, $200,000. The funds made available shall not be allocated to any other phase or components of the project plan, but flexibility is granted in the allotment of the carry-over of the $2.5 million to the items specified above."

The carry-over referred to is the $2.5 million appropriated as part of the FY 68 appropriation of $7.333 million, but not released until now.

Excluded from the authorization are procurement of the copper-clad steel material for the linac tanks, procurement of transformers and switch gear for the site electrical system, procurement of chillers, boilers and water-treatment and cooling equipment, and contingency funds.

That the Transfer Hall rather than the Cross Gallery is authorized appears to be an accident in grouping the structures in the historical format of the Schedule 44 of October 15, 1967. We are requesting a clarification to allow us to construct the Cross Gallery rather than the Transfer Hall (they are equal in cost), because the Cross Gallery provides entrance to the Booster Housing.

In spite of this severe cutback in funds, the Director of the Laboratory continues to hold to the scheduled beam date of June 30, 1972.

2. Development of the Campus. Funds for the development of temporary facilities in the present Village of Weston are included in the appropriation under "Engineering and Design." The village is now in the process of dissolving as a municipality. All except two homeowners have accepted offers from the State for their properties. The Federal Savings and Loan Insurance Corporation is selling all its property in the village to the State as of August 1.

The move of the entire Laboratory to the Campus, planned for August 1, has been postponed because many residents have not moved from the homes we need. It is now planned that individual sections will move as their planned quarters become available with useable communications equipment. Installation of the central equipment for the permanent telephone system is now being carried out by the Western Electric Company and will be completed by about the middle of August; installation of individual instruments is to be carried out by the Illinois Bell Telephone Company.

It is now expected that the Laboratory will begin to move en masse on about August 15, with the move to be essentially complete by September 1.

Construction of the third laboratory building, the rf building financed by Universities Research Association, Inc., is now underway. A photograph attached shows the state of construction on July 31. The building is expected to be ready for initial occupancy and utility-installation on about August 15.

3. Site Acquisition. The State of Illinois expects to begin negotiations for the properties in the remainder of the site (outside the Village of Weston) in August.

4. Laboratory Staff. On August 1, the Laboratory had 222 employees, including 62 scientists and engineers.

## Main Ring

1. Magnet Models. The 3-foot bolted magnet model (B2 configuration) has been assembled, powered, and preliminary magnetic measurements have been made on it. A photograph is attached. These tests are all with dc because the power supply has not yet been made to operate properly as a pulsed supply. The water cooling is a temporary arrangement that allows only intermittent operation, although the evaporative cooler has been delivered and the contract let for its connection. The B vs. I curve is as expected, showing a 3 to 4% saturation at 18 kG and about 15% at 22 kG. The remanent field is as predicted from the coercive force measured for the iron (there are two different kinds of iron in the model), and the sextupole in the remanent field scales as expected with the field. The field uniformity across the aperture is virtually independent of the field value up to 18 kG. There is some lack of symmetry about the centerline, due, we believe, to imprecision in the placement of the conductors in the coils.

A 20-foot half core has been constructed to check fabrication and welding techniques. It exhibits excessive waviness due to the stresses induced by the intermittent welding technique used to attach the side straps to the laminations. We are considering two solutions:

(a) Continuous welds done simultaneously by a four-head automatic

welding machine. Although this could also introduce distortion, such distortions will be of a long-wavelength character so that they can be eliminated by the support given by the box beam.

(b) Notching of the sides of the laminations so that the side straps are set in. The side straps must have their edges machined, and fit well, but then become a part of the magnetic circuit. Spot welds at intervals of 1 to 2 feet prevent the straps from bowing away from the laminations. A notching die has been delivered. An advantage of this scheme is that the overall width of the magnet structure can be reduced significantly. A 20-foot box beam is under construction; the fabricated I-beams have been delivered to the machine shop.

2. Plans for the Coming Month. Negotiations with the computer manufacturers have been completed for the model-magnet testing data-recording system. The order will go out very soon.

The bids for the quadrupole-lamination die have been received with prices within the budget and the order will go out within a week. The coil bids are due shortly.

## Booster

1. Magnet Design. A great deal of attention has recently been devoted to the magnet design. The magnet dimensions have been reduced by allowing some shrinking of the good-field region by saturation at higher energy and by eliminating the inner vacuum chamber. A vacuum envelope surrounding the magnet block would be utilized instead. The outer cross-sectional dimensions of the magnet

will then be 16 inches wide and 12 inches high. Calculations are in progress to determine the acceptable shrinking of the good-field region and to review vacuum requirements and outgassing properties of the materials inside the vacuum aperture.

2. Magnet Power Supply. As a result of the smaller gap height, the stored energy has been reduced. It is now planned to locate the chokes and condensers inside the booster enclosure, making them part of a removable module with an F and a D magnet.

The space requirements in the booster gallery are therefore reduced and it has now been reduced in size to two $90^{o}$ sections (instead of a continuous $360^{o}$ gallery) located above the conjunction with the linac and near the 10 GeV conjunction section.

3. Plans for the Coming Month. It is expected that assembly of the first magnet model will be completed for tests in early September. The dc measurements now in progress to study saturation behavior will be continued.

## Radiation

1. Shielding and Beam Dumps. All major radiation-shielding designs and vehicular penetrations have been finished. Work continues on specific problems as underground galleries, beam dumps, etc.

The beam dumps for the linac and booster will be outside the accelerator enclosures. They will be accessible by excavation.

2. Plans for the Coming Month. The work in the section is shifting towards the radiation problems in the experimental areas and the development of a philosophy for the use of radiation detectors on the site and inside the accelerator enclosures.

## Linac

1. Linac Research Building. Electrical power to the linac machine shop has been installed and the shop is now operational. The power installation to the remainder of the building has not been completed as expected, with the result that power tests on the 500 kW, 200 MHz driver have been delayed. The move of the third linac house between the two existing office buildings adjacent to the research building has been completed. As soon as electric power and the telephones have been reconnected to this building, a general redistribution of the offices will be undertaken to make room for the expanded activities of the section.

2. Modelling Program. Purchase orders have been issued for the 850 kV high-voltage supply, the ion-vacuum pumps for the source and high-gradient accelerating column and the 10 MeV linac tank, the field-measuring and control computer, and the rolling welding and machining of the 10 MeV linac cavity. An RCA-7835 power-amplifier tube and its filament-power supply have been ordered jointly with BNL. Proposals have been solicited for the maching of the titanium electrodes for the high-gradient column and the initial response has been encouraging.

The copper-clad sheets for the fabrication of the 10 MeV linac tank have been cleaned and are awaiting shipment to the tank fabricator. Assembly of an ion-source test stand is in progress. Drift-tube quadrupole fabrication is continuing at BNL and successful quadrupoles are now in production. End faces for the drift tubes have now been stamped out that require only a minimum of polishing. Materials for drift-tubes have now been received and are awaiting machining. Electron-beam welding of the drift-tube closure has been successful on test samples. Deep-hole drilling of the drift-tube stems has been tested.

Several visits have been made to the Continental Electronics Corporation to review the design of the 10 MW rf modulator and the progress on the fabrication of the power-amplifier cavities. A final design of the modulator will be ready for review in about two weeks, with all indications that the projected schedules can be met. Fabrication of the PA cavity is proceeding without delay. A water-distribution monitor for the rf system has been designed by the linac section and proposals for its fabrication are being solicited.

Word has been received that the delivery of the SDS control computer might be as early as the middle of August. This good news has given added incentive to the preparation of a place for its installation and the purchase of additional peripheral and interface equipment. Considerable effort is in progress toward the preparation of a system for the measurement of the RF fields in the linac cavities.

3. Building Design. The culmination of a great effort was realized on July 29 with the submission by DUSAF of the Title I report for the preliminary design of the linear-accelerator facility. Review of the document began immediately and will continue.

4. Plans for the Coming Month. Review of the Title I building design and those elements of the linac design pertinent to the building design will be carried out. Procurement and fabrication of the components for the 10 MeV linac prototype will continue. It is hoped that no further delay in the installation of the electrical power in the linac research building will occur, so that power tests on the existing experimental linac cavities can proceed.

Fig. 1. Erection of Siding on the RF Laboratory Building

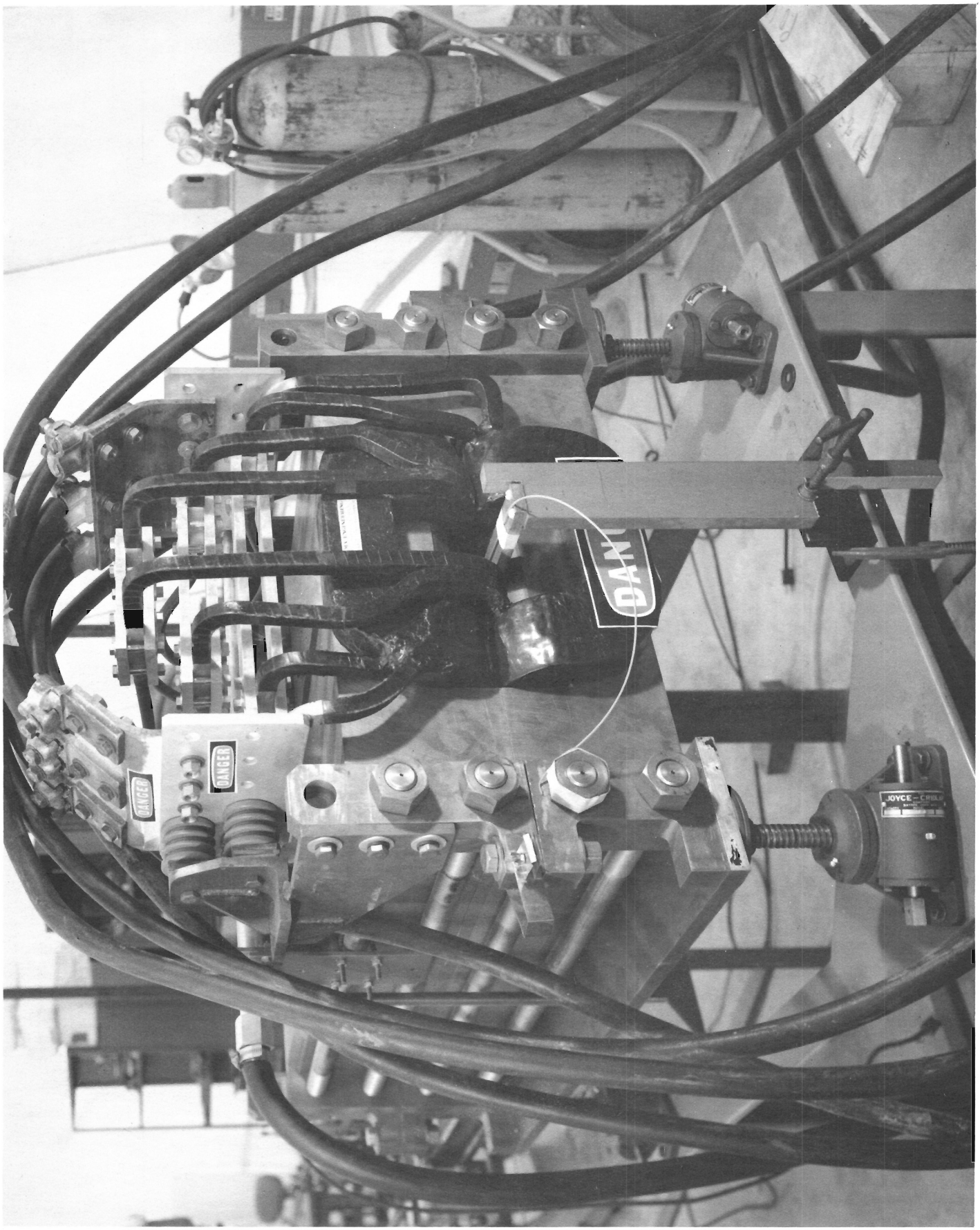


Fig. 2. The Three-Foot Magnet Model