national accelerator laboratory FERMILAB-NAL-030

MONTHLY REPORT OF ACTIVITIES

August 31, 1969

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

General

1. Construction Funds. A total of $6.8 M of new funds was made available for construction in August. Most of this allocation has been committed for building construction as summarized in the next items.

2. New Contracts.

   a. Main-Accelerator Enclosure. A notice to proceed has been issued to a joint venture of the Schless Construction Company and the Thomas M. Madden Company on the first phase of the main-ring enclosure. This phase includes the Transfer Hall, Transfer Gallery, one-sixth of the tunnel, and several service buildings. The contract is for $3.428 M.

   b. Utility Plant. A notice to proceed has been issued to the Herlihy Mid-Continent Company for the first phase of the Utility Plant. This building, located inside the circle of the booster enclosure, will supply heat and cooling to the booster, linac, cross gallery, and central laboratory. This contract is for $1.320 M.

   c. Industrial-Area Buildings. A notice to proceed has been issued to the Wil-Freds Company of Naperville for approximately 31,000 sq ft of industrial buildings. The contract is for $693,693.

3. Construction Progress.

   a. Linac Building. The linac-cavity tunnel is nearly complete, including

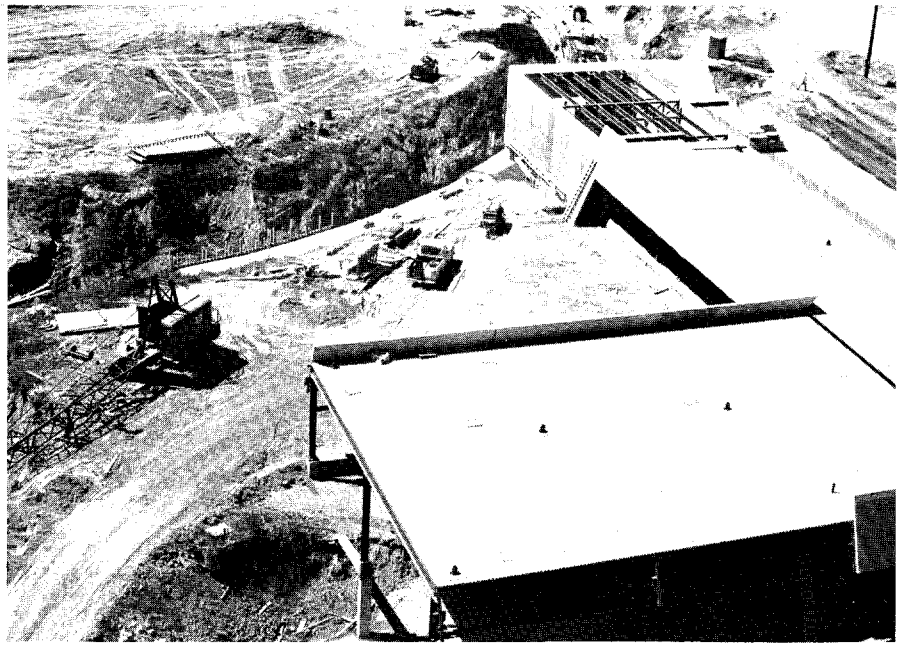


Fig. 1. Progress on the linac building. The roofing and walls are largely up on the equipment gallery. The connection to the cross gallery is in the foreground.

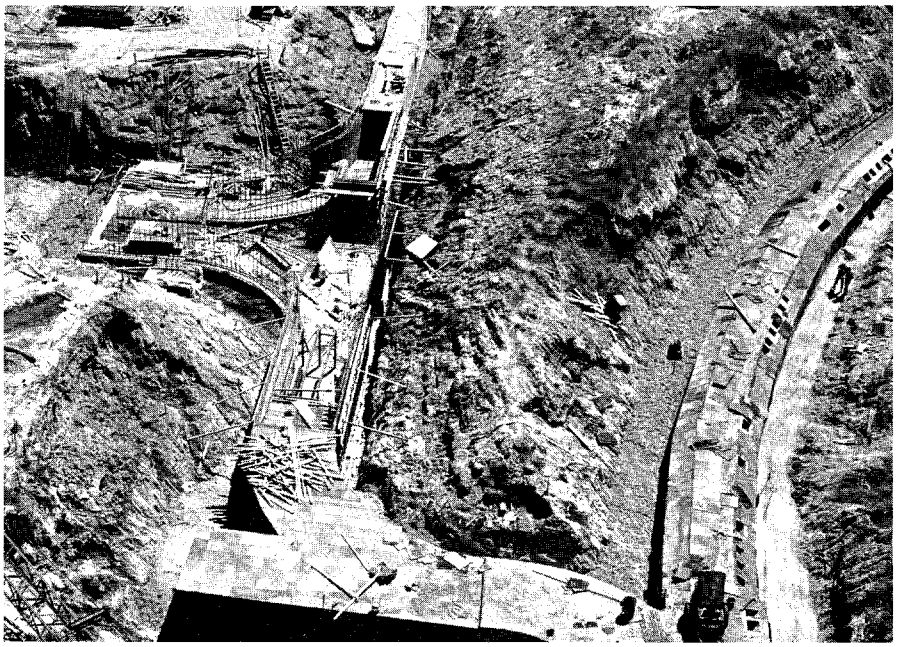


Fig. 2. Connection between the cross gallery and booster enclosure, which is to the right.

the earth shielding. Roof and walls are up on a major part of the equipment gallery, as can be seen in Fig. 1. Plumbing, heating, and electrical installation are in progress. The building is 65% complete.

b. Booster Enclosure. The building is 30% complete, with the main tunnel and access nearly finished.

c. Cross Gallery. The building is approximately 15% complete. The progress of the work and the connection between the booster and cross gallery are shown in Fig. 2.

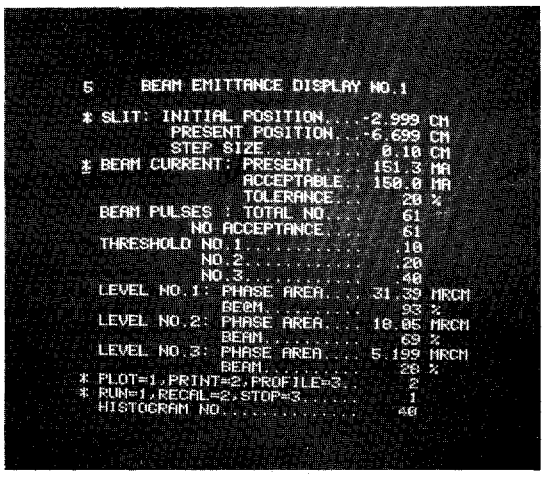
4. Linac Conference. The Laboratory will host the Seventh National Linear Accelerator Conference to be held Sept. 28 - Oct. 2, 1970.

Linac

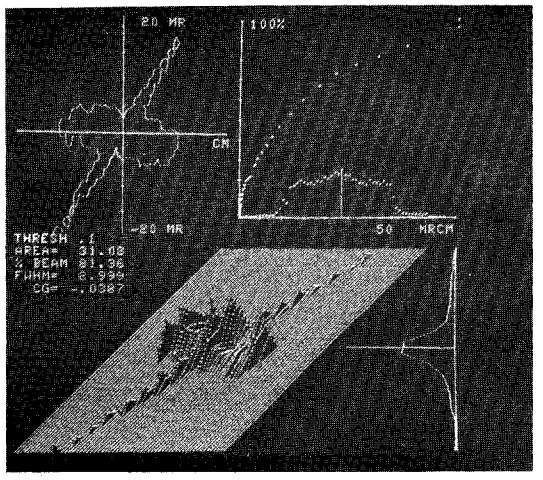
1. 10-MeV Prototype. The beam intensity at 10 MeV was increased to 30 milliamperes. Addition of a buncher to improve the phase acceptance will make it possible to achieve the design intensity of 75 milliamperes. After this intensity (30 mA) was reached, the 10-MeV prototype was shut down for installation of a number of improvements and for realignment of some of the drift tubes. A systematic study of ion-source parameters is being carried out during this shutdown. Improvements in the emittance-measuring system have resulted in the displays shown in Fig. 3. The isometric plots of intensity versus phase-space axes for different fractions of the total intensity in Figs. 3(b), (c), and (d) clearly show the two mass components in the beam, with the protons focused and the molecular ions diverging.

Booster

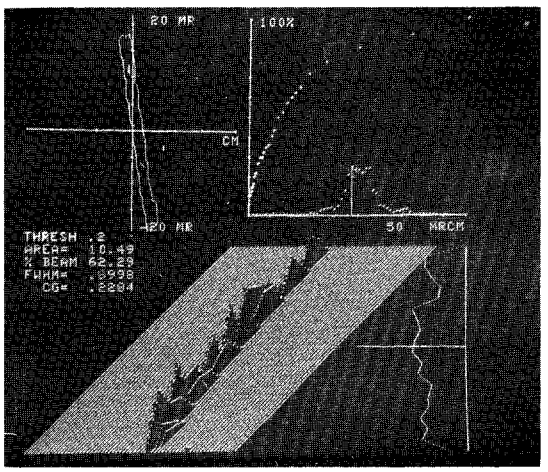
1. Magnet Development. A significant milestone was achieved in August. The design pressure of 5×10^{-7} Torr was achieved in a full-scale prototype



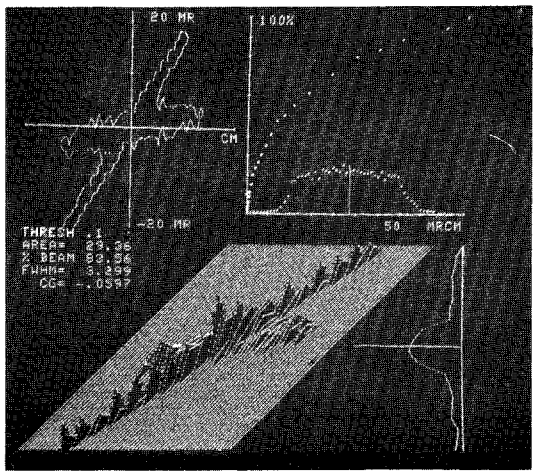
(a)



(b)



(c)



(d)

Fig. 3. Output of the emittance-measuring system. (a) is the parameter display; (b) an isometric plot of intensity versus the horizontal phase-space coordinates x and x'; (c) intensity versus vertical coordinates y and y'; (d) intensity versus horizontal coordinates. (b) and (c) are taken approximately 30 microseconds after the start of the beam pulse, while (d) is taken 10 microseconds after the start; (d) has a much larger H_2^+ content. On the upper left of each print is a conventional phase plot. On the upper right is a graph with the fractional intensity as a function of emittance (upper curve) and (lower curve) intensity as a function of coordinate. On the right, intensity is plotted as a function of angle (x' or y').

magnet, fabricated and baked out in the manner planned for production magnets. The pumping system made use of a 200-ℓ/sec ion pump with a sublimation insert, with no liquid-nitrogen traps or shields.

The first trial end-lamination pack was not successful, but a second one cut with a computer-controlled milling machine is mechanically satisfactory. It has now been installed in the 3-ft magnet model for magnetic measurements.

The two magnets shown on the cover of last month's report have now been mounted on the first model of the support girder. Figure 4 shows the mounted magnets and power-supply units. A second girder is under construction.

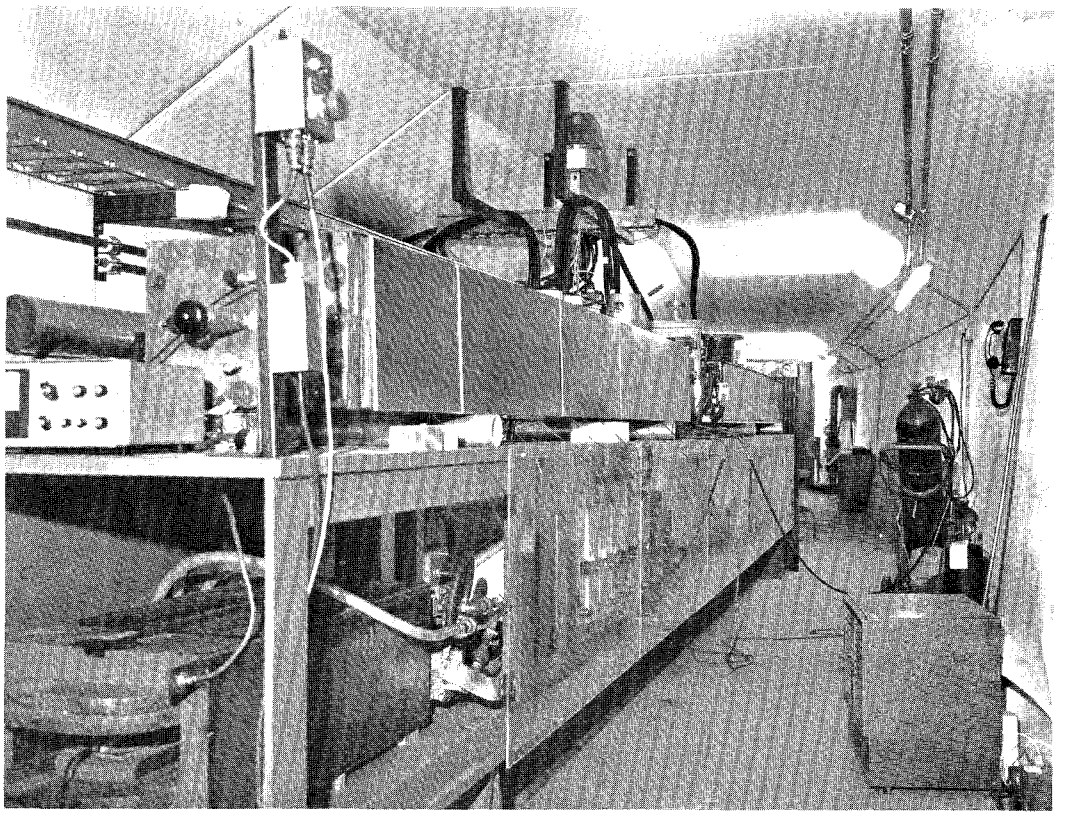


Fig. 4. Booster magnets on model support girder. Capacitor bank and a model magnet used as a choke can be seen mounted under the magnets.

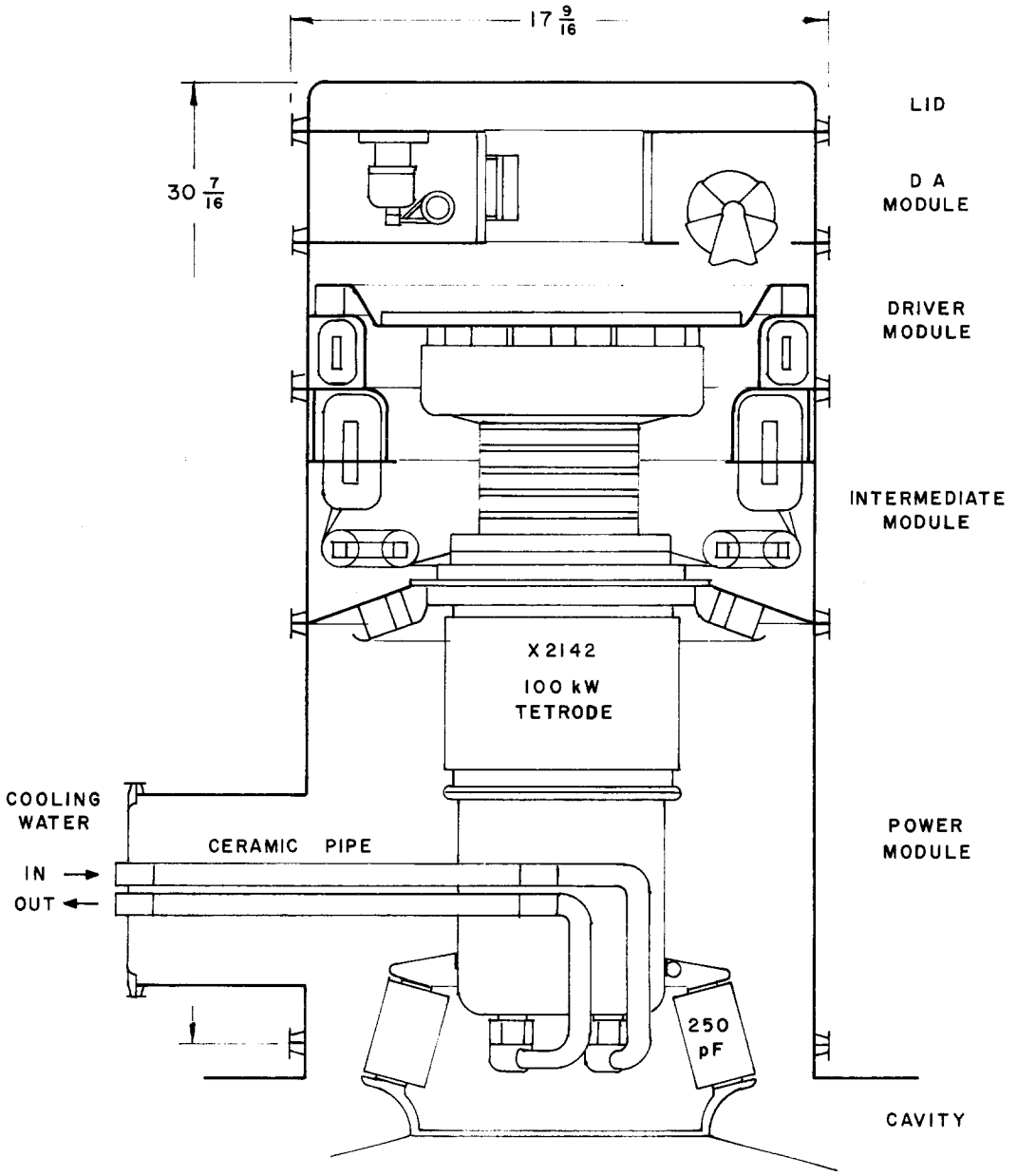


Fig. 5. Elevation view of the booster rf power amplifier.

Radio Frequency

1. Booster System. Figure 5 shows schematically the "cascode power amplifier," a prototype of which is almost complete. Figure 6 is a photograph of the driver assembly of this amplifier.

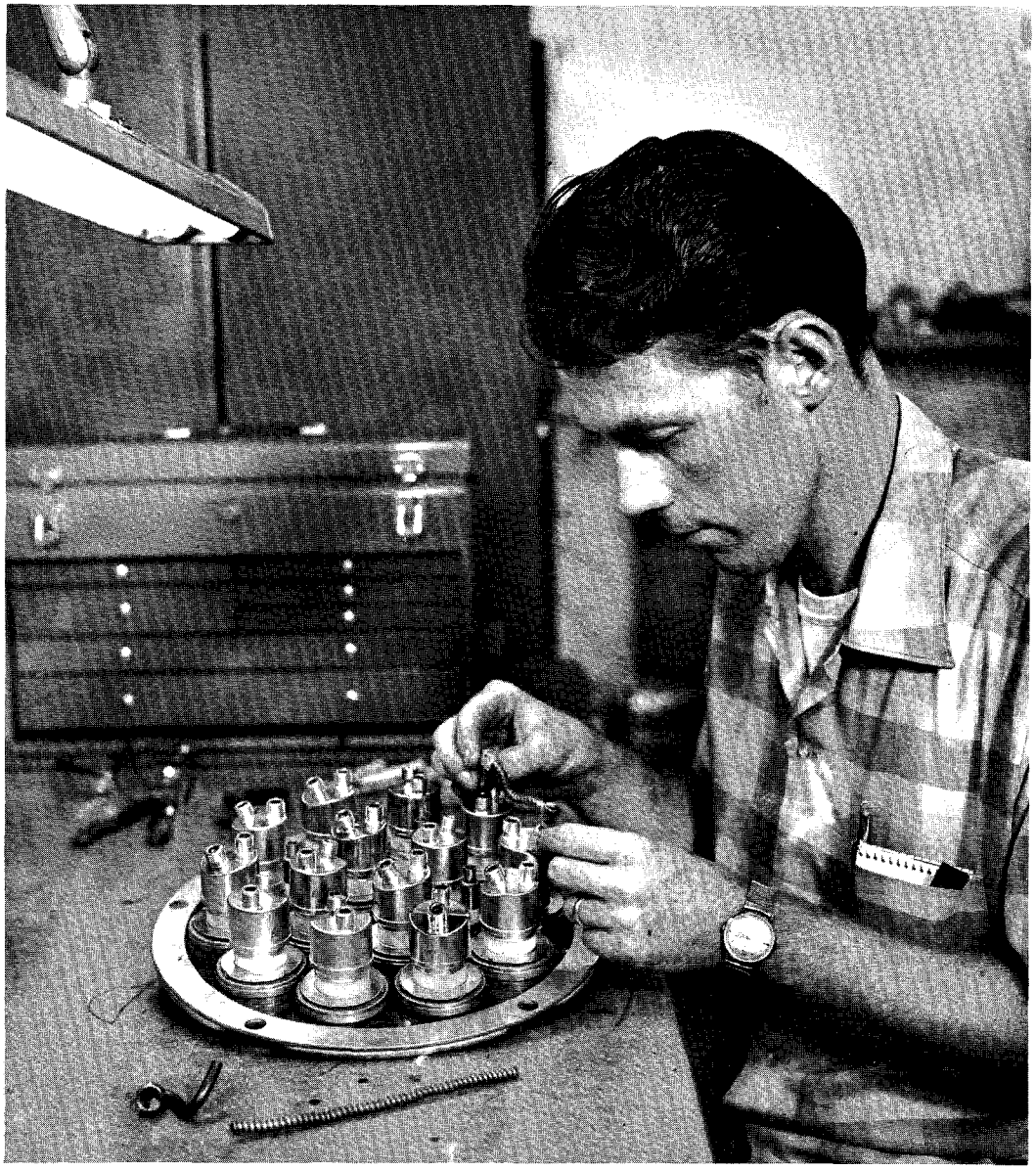


Fig. 6. Driver assembly of the booster rf power amplifier being worked on by Fred Sarver.

The first of the 300-kW power supplies and 250-kW modulators have been delivered and are being tested.

Experimental Facilities

1. Summer Study. The 1969 Summer Study in Aspen, Colorado ended in August. A large number of particle physicists from many institutions participated. Work was carried out to develop further the plans for Experimental Areas 1 and 2 (as described in NAL-25, the monthly report for May), particularly Area 1. As a result of the Summer Study, it has been decided to resubmit to the Atomic Energy Commission the proposal for the 25-ft bubble chamber. Designs for rf-separated charged-particle beams in this area have been developed further.

A significant addition suggested for Area 1 is the provision for carrying out experiments with detectors other than the bubble chamber. Work was done in the Summer Study to plan neutrino experiments with spark chambers. In addition, a method has been suggested for tagging neutrinos in energy.

A total of 3 to 4 secondary-particle beams is now planned for Area 1. Particle beams in Area 2 have also been developed further. Plans now include approximately 6 secondary beams in this area, including high-resolution and high-intensity beams.

These are only a few of the highlights of the Summer Study. The full proceedings, covering 150 papers, are now being prepared for publication.

Physics Research

A Physics Research Equipment Pool (PREP) is being initiated. This equipment will serve the needs of the physics-research section. At the time the accelerator begins operation, this equipment will begin to serve the NAL research program, both of visitors and residents.

Laboratory members will participate in a number of experiments at

other accelerators during the current year. These include measurements at the Argonne ZGS, the Berkeley Bevatron, and the Brookhaven AGS.