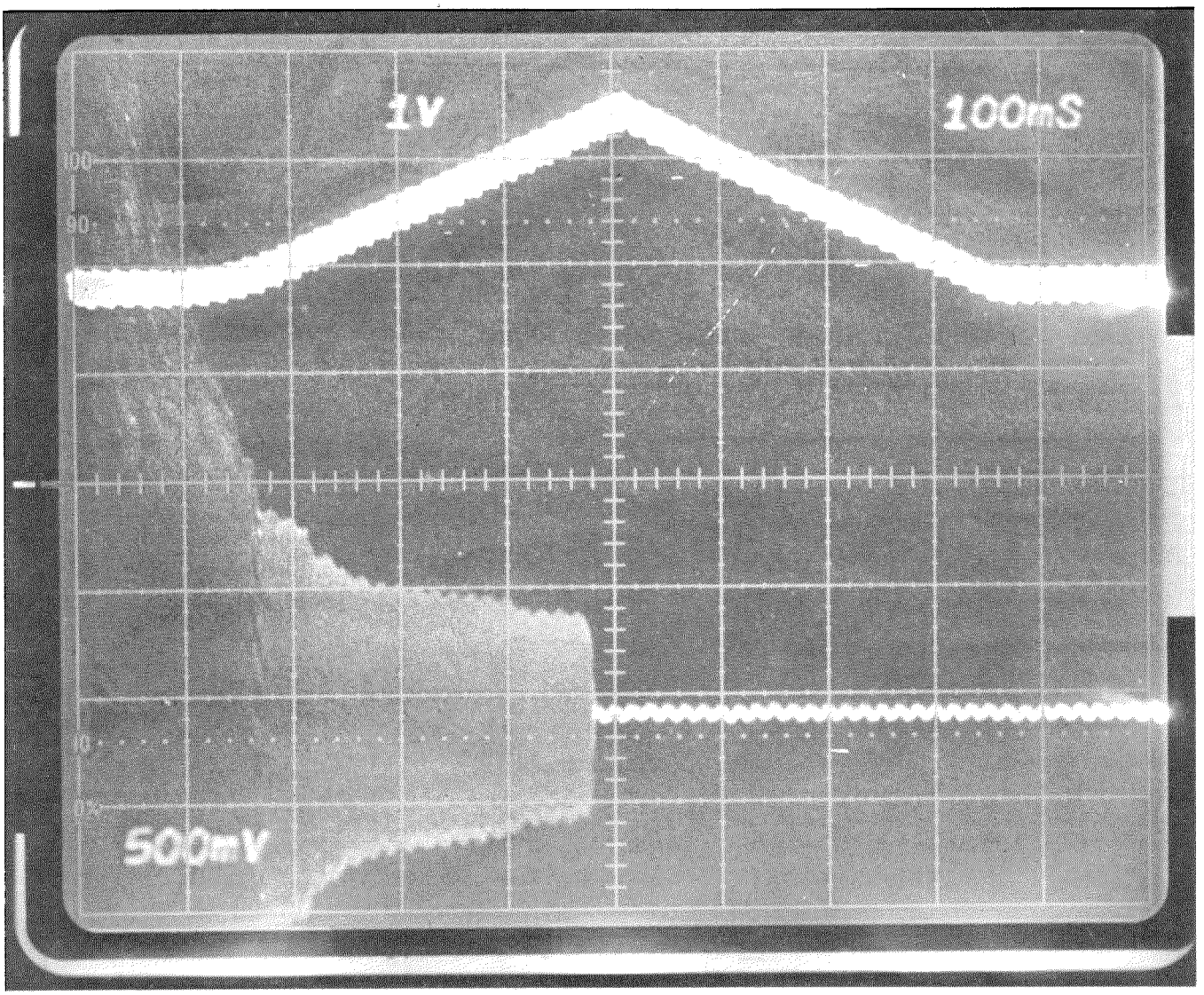
national accelerator laboratory FERMILAB-NAL-067

0090.01

# MONTHLY REPORT OF ACTIVITIES

January 31, 1972




OSCILLOSCOPE TRACE SHOWING ACCELERATION (~20 BeV)

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

THE COVER: The cover shows a beam trace during acceleration to 20 BeV. The upper trace is the magnetic field. The lower trace is the beam trace. The horizontal scale is 50 milliseconds per division.

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Abstract: This report summarizes the activities of the National Accelerator Laboratory in January, 1972.

## Accelerator

The most important event of the month was acceleration of beam to about 20 BeV on January 22. The accelerated beam was stable enough from pulse to pulse that it might well have gone to higher energy, except that the maximum of the magnetic-field cycle was set at a little more than 20 BeV.

We regard this to be important because it shows that the injector, magnets and magnet power supply, and radiofrequency acceleration system all work properly together. We were happy that the beam was accelerated easily through the phase transition at 17.4 BeV, usually a rather difficult part of the acceleration cycle.

This acceleration was made at a rate of 40 BeV/sec. The power supplies have since been reprogrammed to a rate of 60 BeV/sec and more rf cavities put into operation. There are now 13 of the 16 main-ring rf cavities operating, giving a peak voltage of approximately 2.5 MeV/turns (or 120 BeV/sec). Setting up the magnet power supplies for new rates has proved to be time-consuming because the power-supply control program is new and somewhat complex. Tracking of the bending-magnet and quadrupole power supplies in time has been troublesome so all the magnets have now been

reconnected in a single series circuit. At the end of the month, good circulating beam and some acceleration had been obtained, but we are still feeling our way through difficulties.

The magnets themselves have performed very well. Only four magnets have been replaced in January, three during the 1000-V high potting begun in December and one shortly thereafter. No magnets have been replaced for the last three weeks. They have been pulsed to levels corresponding to 100-BeV particles.

No new experiments have been carried out on the gas scattering mentioned in last month's report, but the pressure gauges have been calibrated and calculations carried out. If the measured beam size of 2.5 cm by 1 cm are taken as the limiting aperture, the calculated decay times are in agreement with the measured decay times. It is also interesting to note, as can be seen in the cover photograph, that the decay time increases as the beam is accelerated, as would be expected from gas scattering.

Almost all the injector time in January has been utilized in delivering beam to the main ring, but in spare moments, the orbit straightening discussed last month has been continued, with good results in smaller orbit excursions and greater beam stability.

## Meson Laboratory

The Meson Laboratory enclosure construction has been complete for some time; however, the Meson Laboratory building itself will not be finished until next summer. The Meson target-system installation is nearing completion with the magnets, collimators, and other target components resting on their railroad cars and in place in the target hall.

Most of the beam-line magnets and collimators for the Phase I secondary beams have been constructed and installed but have not received their final alignment (see Figs. 1-4). The Phase I beams are the Diffracted Proton Beam (M2), the Neutron Beam (M3), and the $K^{o}$ Beam (M4). Water and vacuum piping, electrical bus, and cabling have been installed but not yet attached to the magnets. Control cabling is now being installed. The power supplies for these beams have been received and are undergoing testing as shown in Figs. 5-7.

A major part of the Meson Laboratory work during the past year has been the production and testing of dipoles and quadrupoles designed for use in the external proton beams and some of the secondary Meson Laboratory beams (see Figs. 8-11). To date 83 external proton beam quadrupoles and 148 external proton beam dipoles have been built or received.

The first experiment scheduled for Beam M3 has been installed. This is the University of Michigan Experiment 4A as seen in Fig. 12. The target detectors and electronics (including a small computer) are located entirely within the beam line enclosures. Components for some of the other Meson Laboratory experiments are under construction as can be seen in Fig. 13.

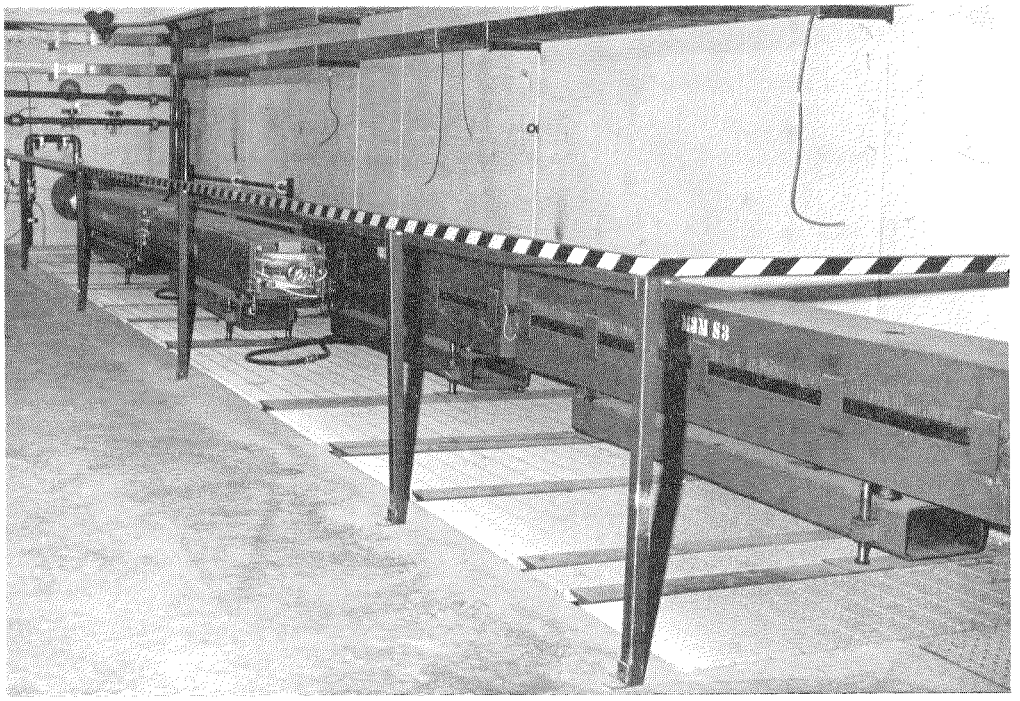

Fig. 1. M2 and M3 beam lines. M4 is beneath M3. Muon spoilers front end - M3. EPB dipole front end - M2.

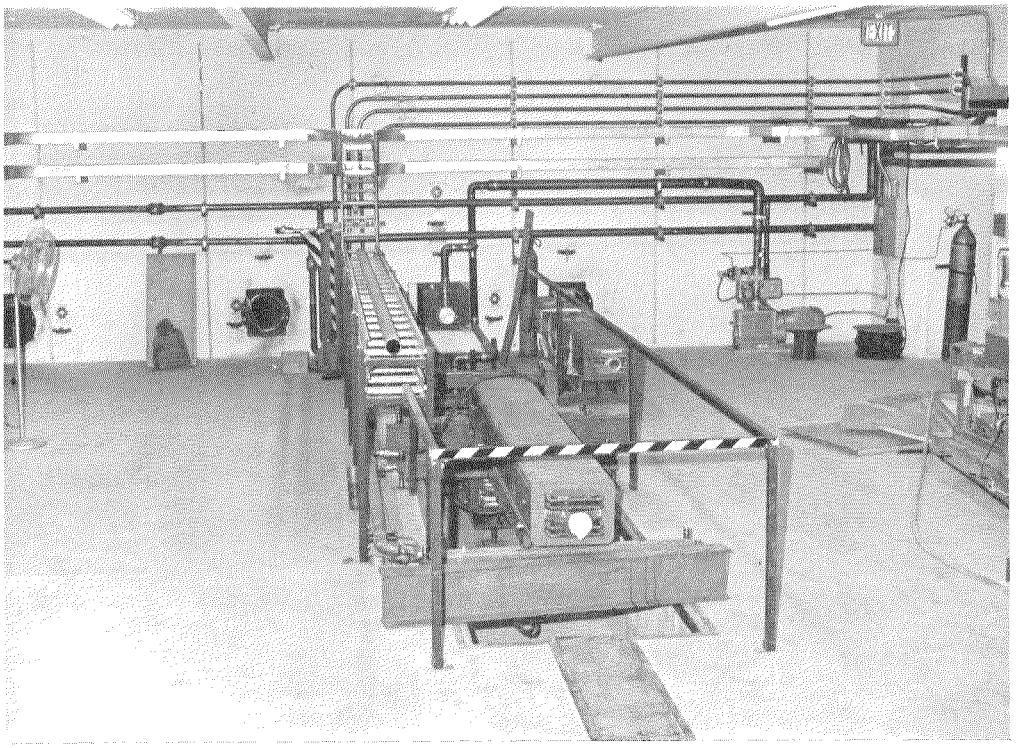

Fig. 2. Front End Enclosure looking down stream.

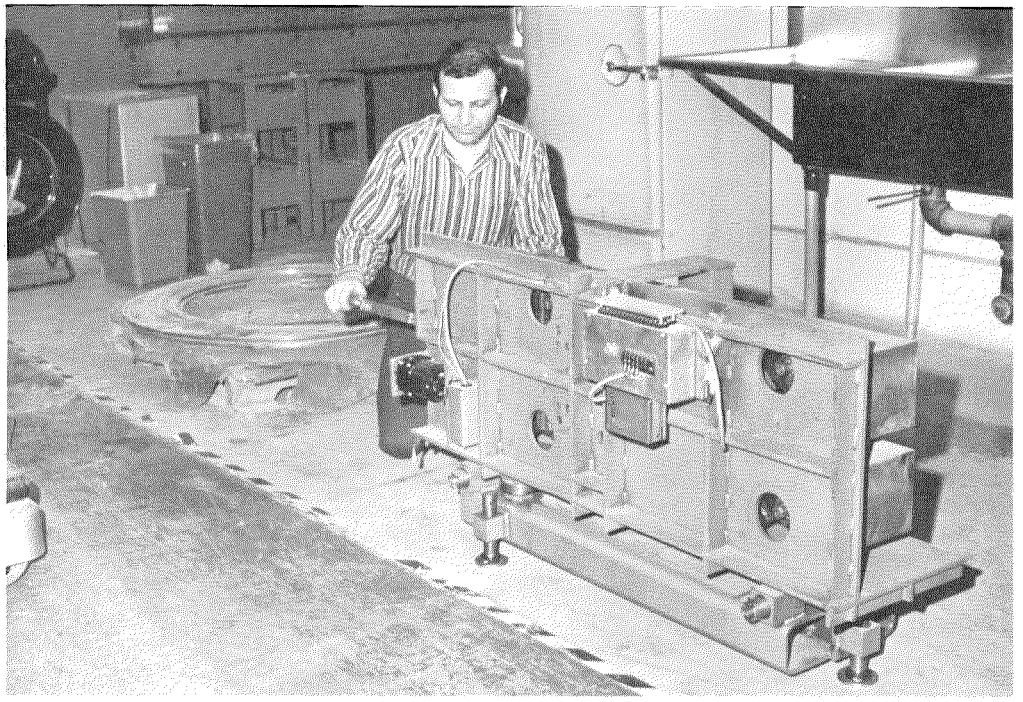

Fig. 3. D. Zafiropoulas readies vertical collimator.

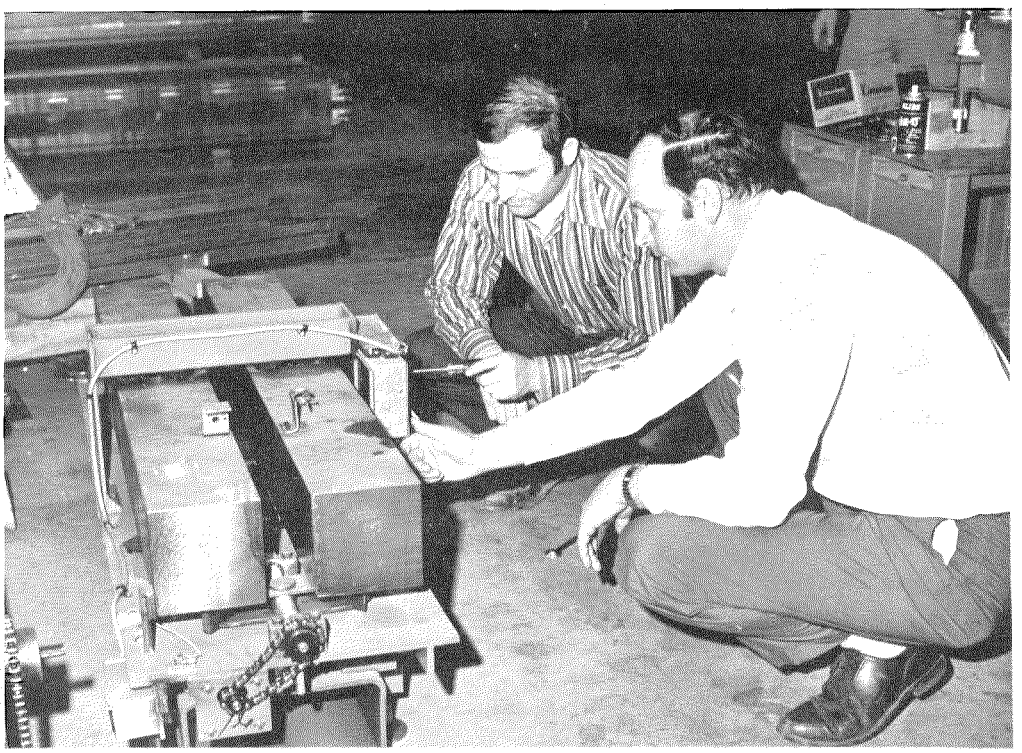

Fig. 4. J. Humbert and D. Zafiropoulas putting horizontal collimator through its paces.

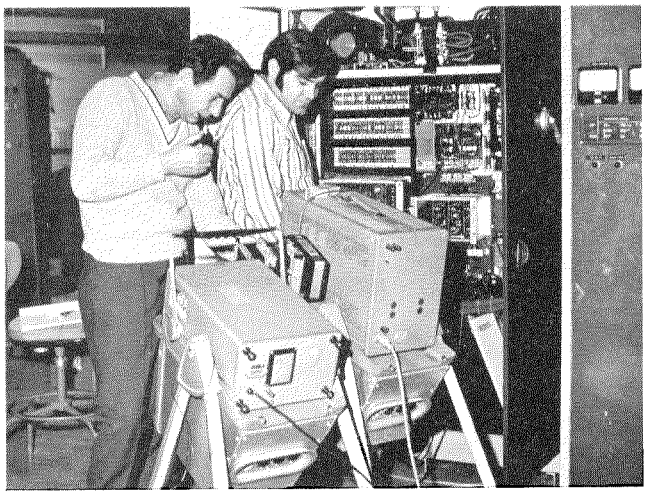

Fig. 5. Jan Ryk checks 1500 amp power supply with factory representatives.

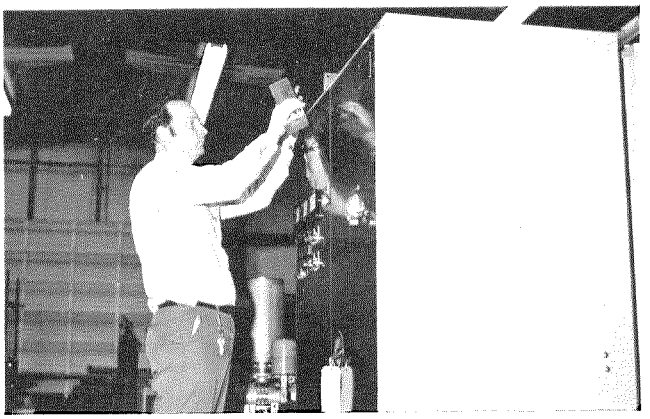

Fig. 6. J. Humbert makes final check on 1500 amp power supply.

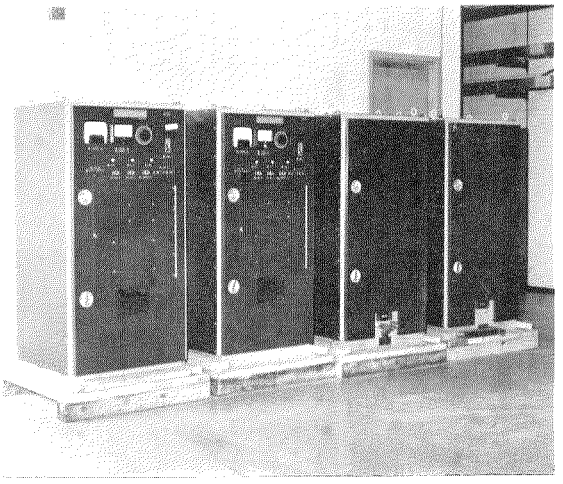

Fig. 7. Quadrupole magnet power supplies ready for installation - Service Building M2.

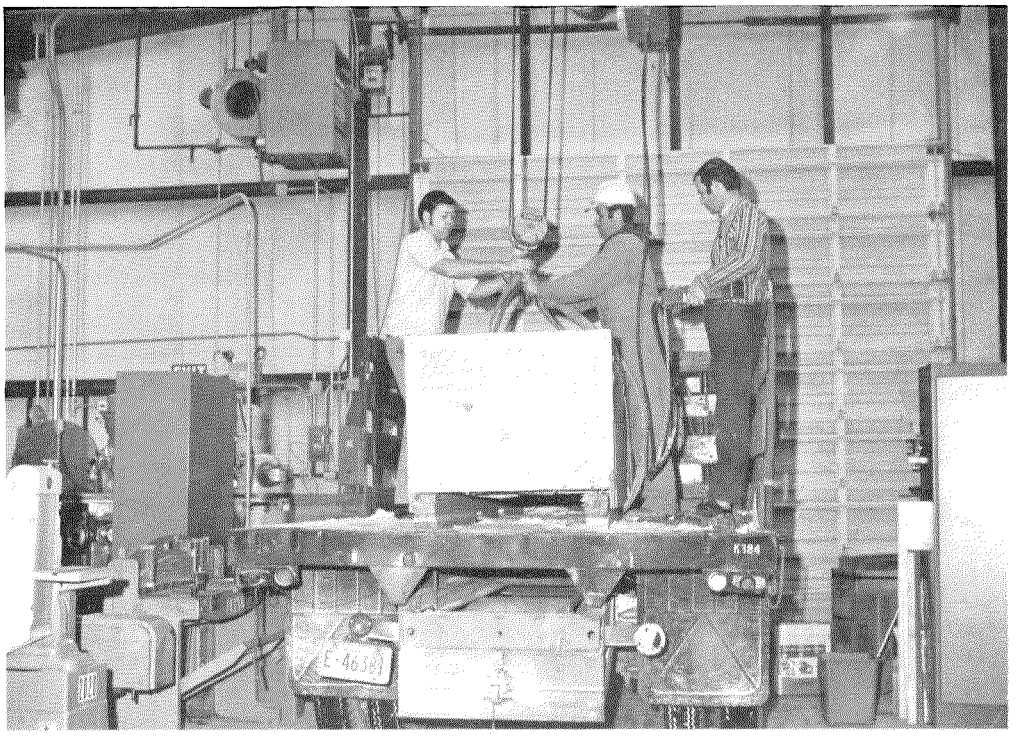

Fig. 8. EPB dipole from Thomson Electric, Canada.

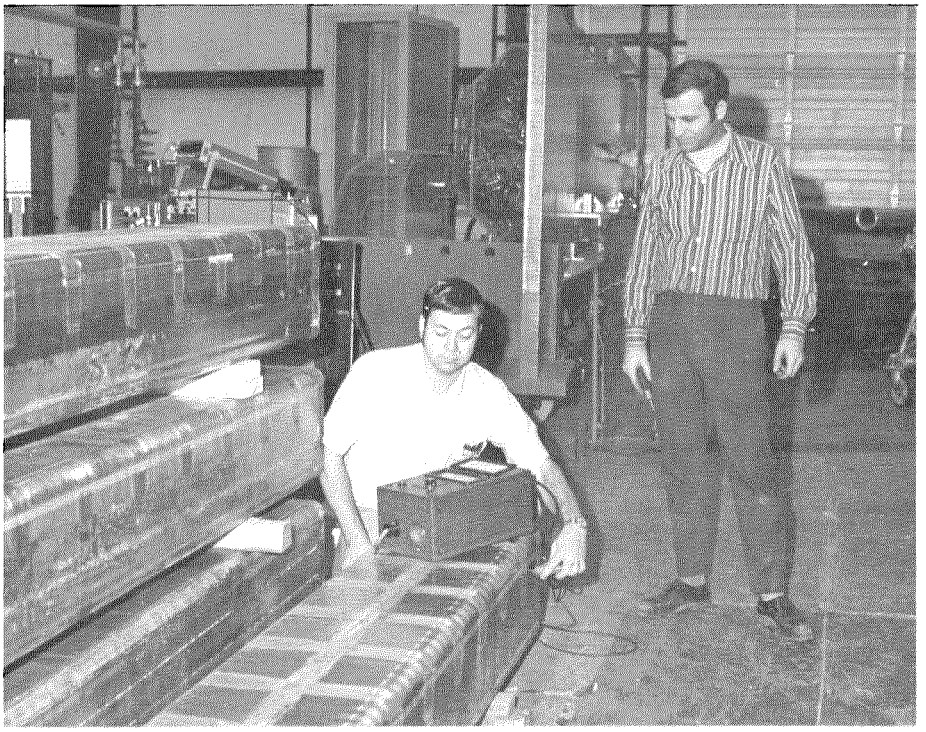

Fig. 9. R. Horbus and D. Zafiropoulas test coils in EPB dipole magnets.

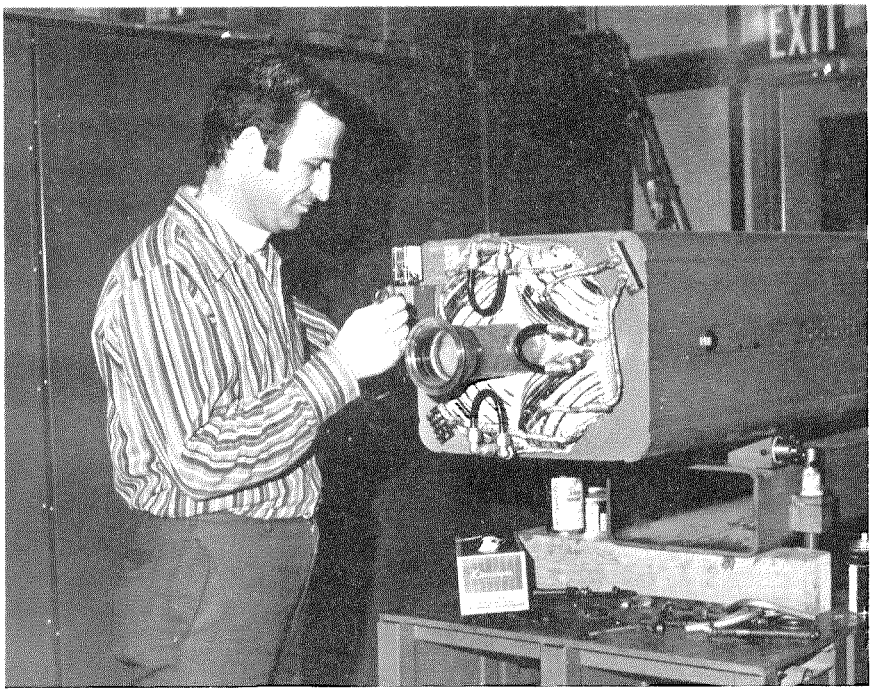


Fig. 10. D. Zafiropoulas makes final hookup of cooling water manifold on EPB quadrupole magnet.

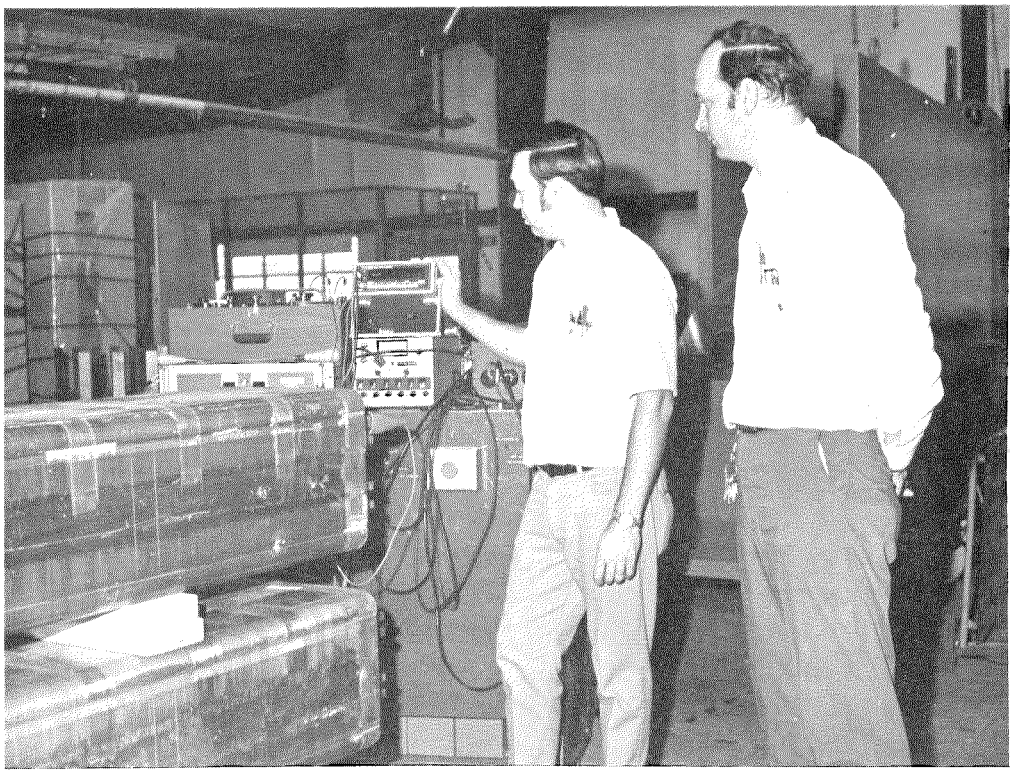

Fig. 11. J. Humbert and R. Horbus testing EPB dipole magnets.

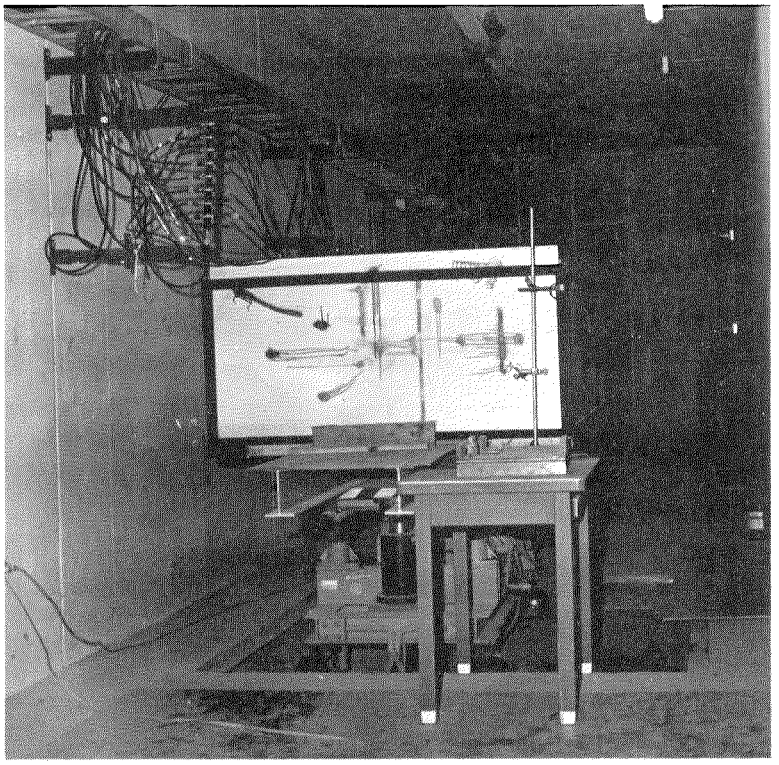

Fig. 12. University of Michigan Experiment 4A - neutron collimator.

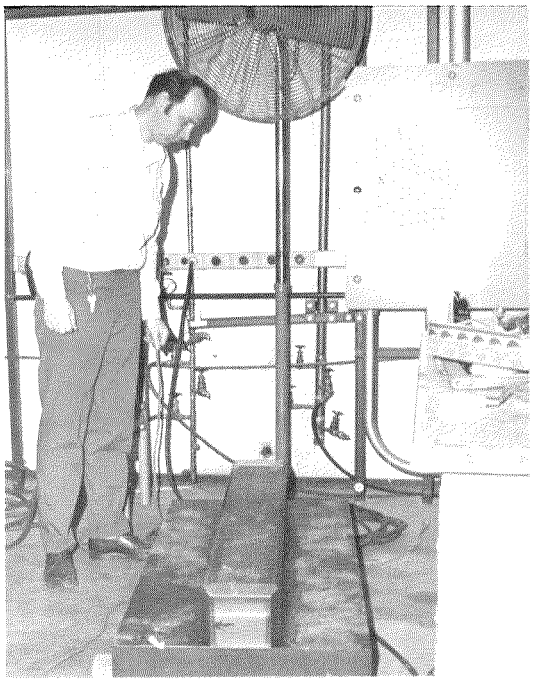

Fig. 13. Iron core for sweeping magnet - Experiment 82.