national accelerator laboratory FERMILAB-NAL-071

0090.01

MONTHLY REPORT OF ACTIVITIES

May 31, 1972

NAL AUDITORIUM

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

THE COVER: Photograph of auditorium taken just after precast side panels had all been set in place on May 28, 1972.

NAL-71
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Abstract: This report summarizes the activities of the National Accelerator Laboratory in May, 1972.

Auditorium

The precast concrete sections which form most of the wall structure for the Auditorium were put in place over the Memorial Day weekend. Work is proceeding on schedule on this building, and it is still expected that it will be completed for use when the Laboratory is host for the XVI International Conference on High Energy Physics in September.

Accelerator

Protons were extracted from the synchrotron and led, via the neutrino target, to the 30-inch bubble chamber, some 1.5 miles from the extraction point of the main accelerator. The peak energy of the machine during these studies was 80 GeV. The bubble chamber is now being cooled down and the next goal of the Laboratory is to consumate the first exposure run--50,000 pictures of 200-GeV protons passing through the chamber--for the Argonne workers who moved the chamber to NAL.

Three other experiments have been initiated in one of the long straight sections, C-0, using an internal target. The target is presently a thin foil of polyethylene that rotates through the beam, but this is to be augmented by the gas jet target that was brought from Dubna by our Soviet visitors:
V. D. Bartenev, A. A. Kuznetsov, V. A. Nikitin, IU. K. Pilipenko,

V. V. Popov, L. S. Zolin, and B. A. Morozov. They now have the target working at NAL, and it is hoped that it will be installed in the accelerator some time in June. (See Fig. 1.) Their experiment, being made in collaboration with NAL, Rockefeller University, and the University of Rochester is to measure the elastic scattering of protons by protons at small angles (actually they measure the recoiling proton). The first result should show how the apparent radius of the proton varies with energy. Another experiment that will share the target is a simple measurement of gamma rays by physicists from Harvard University and the University of Wisconsin. Yet another experiment is being started by a group from Rutgers University, Upsala College, and Mississippi State University in which recoil protons are measured at an energy where kinematic enhancement makes it possible to identify resonance structure in the proton.

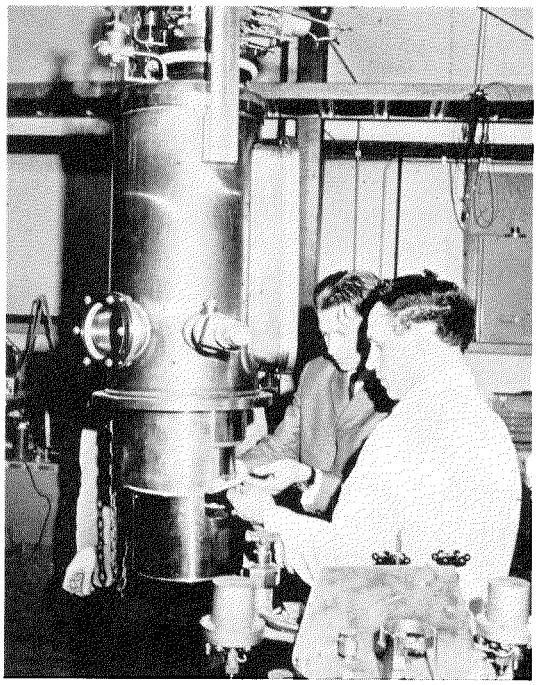

Fig. 1. IU. K. Pilepenko and V. D. Bartenev working on reassembly of the hydrogen jet target brought from the USSR.

A number of studies were also made of the circulating beam during the month. Many sets of orbit positions were measured during the month. Several iterations of quadrupole realignments were carried out on the basis of computer simulation of the measured positions. Vertically, the closed-orbit distortion is now smaller than ±1 cm throughout the accelerator. Horizontally, it is less than ±1 cm except in a few places, where it is about ±0.5 in.

Although there were occasional forays to 200 GeV, the peak energy was kept to 80 GeV during most of the studies. The accelerator intensity has been improved steadily over the last several months. Figure 2 shows a beam trace corresponding to an intensity of $5 \cdot 10^{10}$ protons taken May 29. The intensity

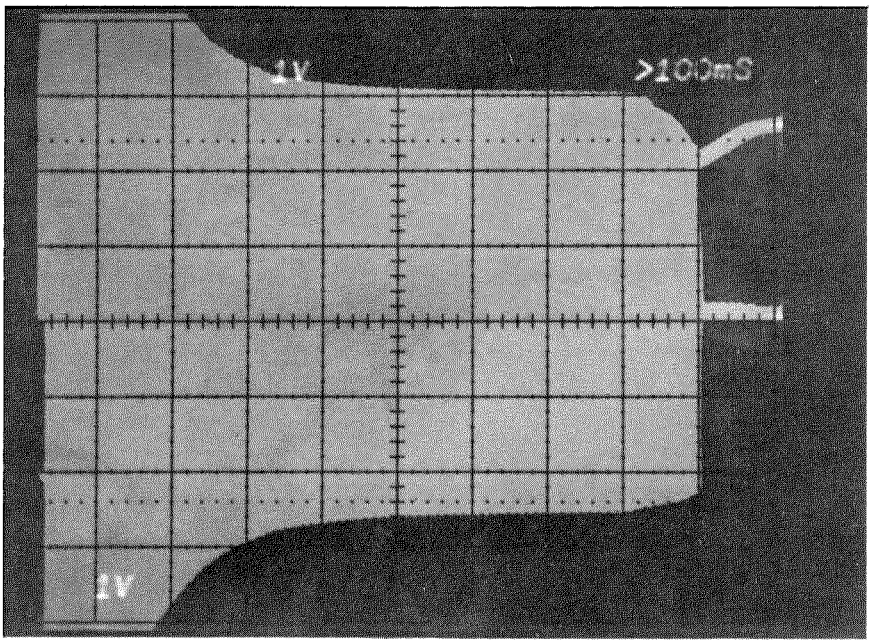

Fig. 2. Accelerated beam, taken on May 29. This signal, which obscures most of the trace, represents approximately $5 \cdot 10^{10}$ protons. The dip at the end is caused by turning on an orbit bump for extraction. Extraction itself takes place at 74 GeV.

has increased by a factor close to 50 in the three months since beam was first accelerated to 200 GeV. It may be noted that there is still decay of the beam

at injection before acceleration begins. In the best operating conditions, about half the beam is lost by this decay--most of it occurring as the power supplies come on to provide the ramp to high energy.

During May, no magnets shorted. The injector has been operating with good reliability at 7.2 GeV. Protons were accelerated to high energy in the main ring for 107 hours out of a possible 167 hours. Some experiments were performed on multiple pulsing the booster, and it is expected to operate at 15 Hz in the next few months. The booster has now accelerated beam stably on only 14 of the 16 rf cavities, which is close to the nominal design.

Water System

Since the low conductivity primary cooling water system for the main ring was described in a previous monthly report, this description is of the secondary pond water system only.

The circular system of 25 ponds is intended to provide cooling for less than half of the heat generated in the main-ring magnets, plus cooling for the RF Building. The major portion of the heat will eventually be dissipated in air-cooled radiators, of which there are to be two per service building.

The heat transferred to the cooling ponds results in the evaporation of as much as several hundred gallons per minute of pond water. The water to replace this loss comes from several sources. An automatic pond water makeup system takes water out of the Industrial Cold Water pipeline which, at this time, is fed from two shallow wells or from collected rain water. As soon as the main reservoir located near the Neutrino Lab (see Figs. 3 and 4) is completed, it will be connected to the ICW pipeline. At that time, it will no longer be necessary to use water from the shallow wells for cooling, except

Fig. 3. Aerial view of the site. A is the main reservoir (Fig. 4); B is the main-ring pond (Fig. 5); C is Lake Law (Fig. 6); D is Ephemeral Lake (Fig. 7). It can be seen that water has also collected on other low areas on the site, e.g. the center of the main ring.

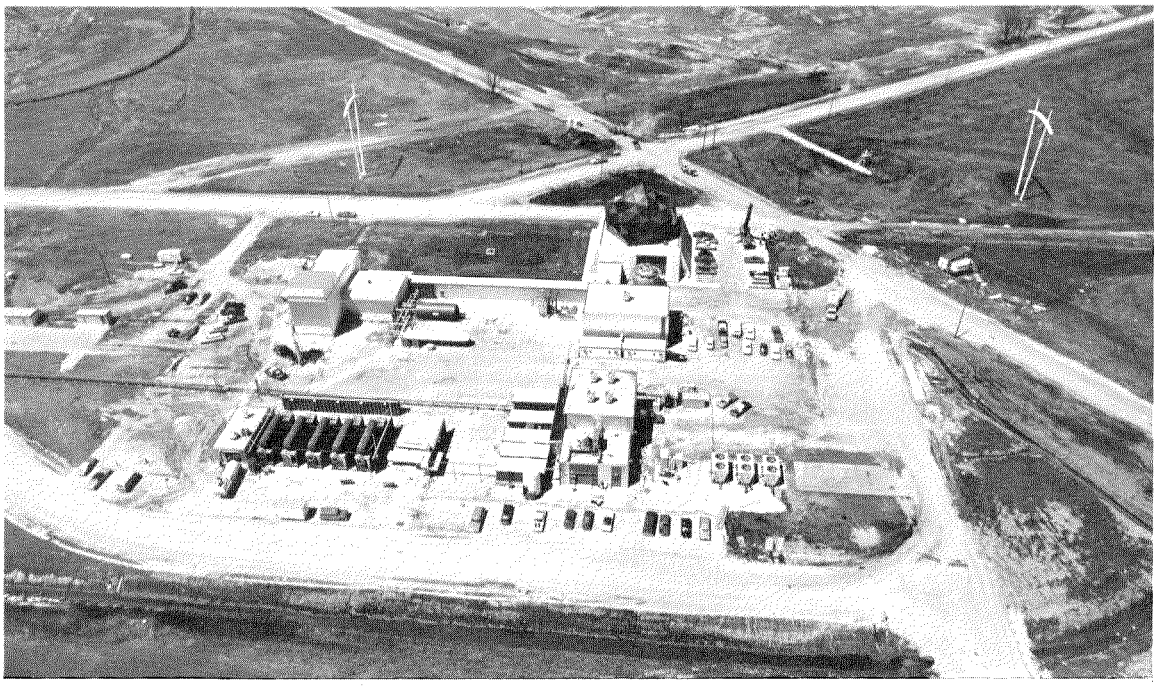

Fig. 4. View over the Neutrino Laboratory (looking northwest) with excavation for the main reservoir in the background.

for dire emergencies. The main reservoir will receive water from three sources: 1) A pipeline pumping water from the Fox River which will empty into a ditch which in turn empties into the reservoir. 2) Rain water falling on the northwest portion of the site will be led by a series of ditches to the same reservoir. 3) Rain water from the center of the main ring, which collects in a reservoir at the eastern part of the main ring, as seen in Fig. 5, can be pumped through an abandoned gas line to a ditch which empties into the main reservoir.

There are several other reservoirs which are not directly connected to the main reservoir, but whose water can be transferred to the main reservoir by means of portable gasoline pumps and hose. Lake John Law which can be seen in Fig. 6 is located southwest of the Village and is currently the largest

Fig. 5. Part of the main-ring water system can be seen in this photograph (looking south from the north part of the ring). Main-ring storage pond can be seen in about the center of the photograph.

Fig. 6. Lake John Law (looking northeast from the ring) at peak level in May.

of these. We discovered last summer that a fortuitously placed abandoned gas line connected Lake Law with Cress Creek which runs through the northern portion of the site. This proved quite helpful in filling this reservoir last year. East of Lake Law is Ephemeral Lake which can be seen in Fig. 7.

Fig. 7. Ephemeral Lake, with Sea of Evanescence at upper left (looking south from east of Village).

Ephemeral Lake collects rain water from the eastern portion of the site, plus runoff from the Village septic pond and any other water used in the Village. A proposal to increase the size of this reservoir is now under discussion. South of Ephemeral Lake is the Sea of Evanescence, also visible in the distance in Fig. 7. This is presently a rather small reservoir collecting rain water

from the southeastern portion of the site. However, plans to increase it considerably are also under discussion. Last, there are two very small sandbag dikes across Indian Creek, which is in the southwest portion of the site.

The final source of water for cooling is a deep well, which principally allows us to monitor the deep aquifer for radioactivity, but which could be considered as a source only in some dire emergency.