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FERMI NATIONAL ACCELERATOR LABORATORY

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TEVATRON I TESTS LITHIUM LENS AT CERN



← From left to right, Doug Booth, Luke Hardy, Ron Le Beau, Gerry Dugan, Carlos Hojvat, and Fritz Lange contemplate lithium lens #1 after the high pressure liquid lithium filling operation.

by Carlos Hojvat

The antiprotons collected in the TeV I project are produced when 120-GeV protons from the Main Ring strike a target. But the antiprotons are produced in a spray and need to be focused into a beam that can be transported to the Debuncher ring. This focusing is done by a lithium lens. A very large pulsed current along a lithium rod produces a strong magnetic field around the rod and this field bends the antiprotons toward the axis.

Tevatron Triumph!

On Wednesday, February 15, an 800-GeV ramp was set up in the Tevatron and achieved by 6:30 p.m. after two quenches. The Tevatron then accelerated and extracted beam to 800 GeV by 10:54 p.m.

The push for an 800-GeV ramp began early during the day shift. Recovery from two mid-afternoon quenches (770 and 700 GeV) caused a delay in the efforts. Improper helium flow for the magnet leads at E3 necessitated a Tevatron access at the start of the evening shift on February 15, but by 6:30 p.m. an 800-GeV Tevatron ramp had been established. By 8:44 p.m. beam had been accelerated to flattop and was extracted to the switchyard dump 10 minutes later. The remainder of the Wednesday midnight shift saw an intensity rise.

The concept of this lens was developed in 1949 when W. K. H. Panofsky and W. R. Baker proposed the utilization of the cylindrically symmetric magnetic field that occurs within a conductor carrying an electrical current for the collection of secondary particles. If the current density within the conductor is uniform then the field increases linearly with radius. If it is focusing, it is axially symmetric (in both planes at the same time). Panofsky and Baker chose to use a plasma as a conductor
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Soon after completion of the first lithium lens and transformer assembly for testing in the basement of Wilson Hall.

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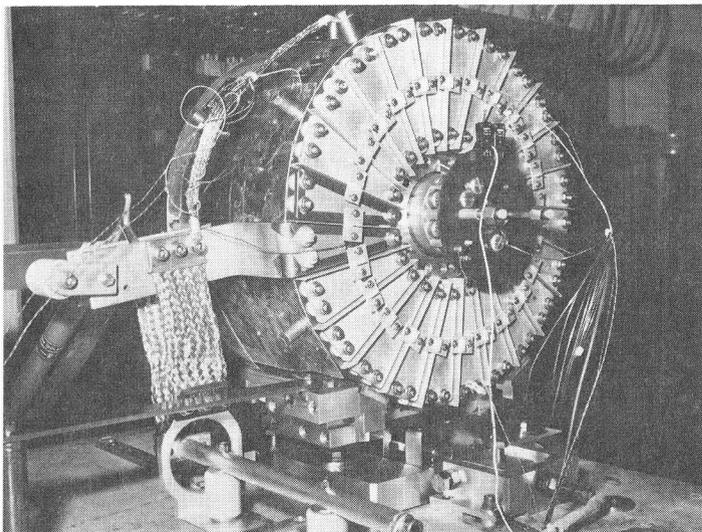
and built such a lens for the 350-MeV proton beam of the 184-in. cyclotron at Berkeley. A "plasma" lens was also developed in the 1960's by Leon Lederman and collaborators for the neutrino beam at Brookhaven National Laboratory.

Gersh Budker, of Novosibirsk, USSR, suggested the use of lithium as the conducting medium for the construction of lenses for high-energy beams, choosing it because of its low density (low absorption) and low atomic number (low multiple scattering). Lithium lenses have been under development at the Institute for Nuclear Physics, Novosibirsk, and used for the production of e^-e^+ for their accelerators. Lenses for the focusing of high-energy proton beams with gradients of 4000 T/m have also been built there. As a result of a collaboration between the INP and Fermi-

lab, a design based on the INP experience was developed at Fermilab and the production of lenses has started. The first two prototypes were taken to CERN for beam tests. These lenses are 15 cm long and 1 cm in radius, capable of reaching gradients in excess of 1000 T/m and repetition rates of 0.5 Hz. Focal distances of the order of 12 cm can be achieved for antiprotons of 3.575 GeV/c momentum, with currents of the order of 500,000 amperes. The lens forms part of a single-turn secondary, coaxial to the lens, with a primary of 8 turns. This design minimizes the effect of inductances other than the one of the lens itself. The Fermilab lenses have been built and designed by the \bar{p} production group of the Tevatron I project (Carlos Hojvat, group leader) with Gerry Dugan as project leader.

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The Fermilab lithium bus and transformer mounted at CERN. The lens can be seen jutting out from the transformer aperture. Water-cooling lines have not been connected in this photo.

One of the prototypes was installed in the target station of the AA rings during September 15-16, making it the first time that one of these devices has been installed in a hadron beam. A total of 16 hours of beam time was used for the study of the lenses, resulting in an increase of the CERN M record of antiprotons collected per pulse by 37%, as compared to an expected number of 42%. A further period of two days of beams could not be used due to a failure in the transformer. Although the test program was not completed, valuable information was obtained to check on the design for the Fermilab Antiproton Source.

Lithium lenses are expected to play a major role in any future upgrading of the Antiproton Collector/Accumulator at CERN and are part of the Antiproton Source design at Fermilab. The success of these tests was due to the dedication of many people. Among the people not appearing in the photograph are Finley Markley's group of the Materials Laboratory for the installation of the lithium laboratory and Frank Krzich's group that provided the water-cooling system.

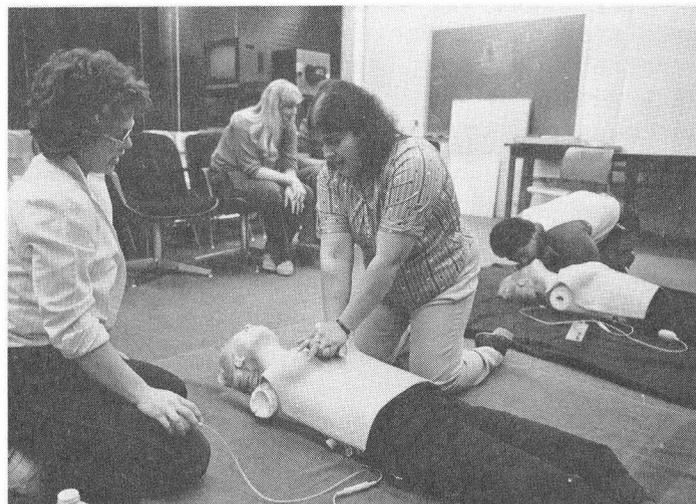
Deadline Near For Summer Housing

The deadline for receipt of reservations for summer on-site housing is Thursday, March 22. Responses will be mailed April 13.

CPR TRAINING OFFERED

One of the numerous safety training classes presented by Fermilab is cardio-pulmonary resuscitation (CPR) which utilizes lecture demonstration, a variety of visual aids, and student practice on instrumented mannikins.

The instructor for this course is Ann Casperson (Accelerator-Cryogenics) who is certified by the National Heart Association. Ann formerly presented this training at College of DuPage and she now instructs at Delnor Hospital, St. Charles. The nature of this training requires that class size be limited to eight to assure individual attention. Training is currently offered several times a month and arrangements are made through a division safety officer. Participants are normally selected from a wide cross section of the Laboratory, so that the probability of having trained people throughout Fermilab is enhanced.



Left to right, Ann Casperson (Instructor), Accelerator Division; Maria Vargas, Lisa Hernandez, and Raymundo Fonseca.

Fermilab has **also** arranged for Ann to present CPR training to users and their dependents twice a month from 9 a.m. to 12 p.m. the first and third Saturdays of each month. This training will begin in March and continue through the end of the summer. Class size is limited to eight; the lower age limit is 16. Upon completion of this training, the student will know how to perform mouth-to-mouth resuscitation and closed heart massage. Ann will also teach the technique for removing an obstructed airway (choking), the seventh leading cause of accidental death.

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MOTORCYCLISTS REV UP: LUNCHTIME PROGRAM GEARED FOR YOU

by **Charlie Bonham**

Our typical lab motorcyclist is just waiting for that spring morning when the battery is re-installed into the machine. Then, with the hesitating start of the engine, those first sounds of life and the smokey exhaust blow away all but the memories of winter. Are **you** ready? Well, to break this transition from that of a hibernating toad into a junior Kenny Roberts, the Accelerator Safety Group and the Business Services Safety Group are sponsoring a lunchtime program aimed at getting both you and your machine set to go. A series of six programs is planned which will start on Tuesday, February 28, and continue every Tuesday for the next five weeks. The programs will be presented in the 1 West Conference Room from 12:15 p.m. to 12:45 p.m. so bring your lunch. Each program will generally include a motion picture and a speaker from our laboratory resources of bikers. Mark Gorecki, Accelerator Mechanical Support, is an experienced racer and tuning artist who will brief us on how to inspect and ready our machines for the long summer ahead.



Anne Burwell and her Honda Interstate on the 1983 Arthritis Foundation ride in Missouri.

Anne Burwell, Program Planning, is our foremost cross-country tourer. Anne is going to talk to us about getting ready for that possible tour you dreamed about all winter. Anne will tell you what to take, how to pack it, and where to go. She will also discuss "United Motorcyclists of Illinois (UMI)," a bikers' political action group for Springfield. UMI membership has some attractive discounts that may make

membership economically desirable with respect to cycle insurance, etc.

Is it going to be a "safety harangue"? No, not really but we do plan on including certain safety information that you will find interesting. We're coming from the fact that we have lost three of our biking buddies in the last two years plus others who have had very serious injuries. Gary Andrews, Business Services Safety Group, has some good material that he brings to us from Northern Illinois University's motorcycle safety project where he serves as an instructor.

Bring your lunch and we'll see you there. Watch for our posters in the usual places. For more information, phone Gary, ext. 3036 or Dan Villarreal, ext. 4461.

CPR CLASSES OFFERED TO USERS

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To arrange for this training, interested individuals should contact Dan Villarreal at ext. 4461. Names will be placed on a waiting list and will be contacted approximately one week prior to the start of the training. Because of limited instructor availability, this special program is limited to users and their dependents.

For others interested in obtaining this training outside the Laboratory, there are generally openings in the monthly classes held every second and third Tuesdays from 7 to 10 p.m. at Delnor Hospital, and many of the other area hospitals also offer this training to the public.

Congratulations To . . .

Richard (TS/Refrigerator Operations) and Beth Rebstock on the birth of Raymond Travis on January 12 at Copley Memorial Hospital in Aurora. Raymond weighed 7 lbs. 14 oz. and was 20-1/2 in. long.

Deborah (Safety Section) and Jack Grobe on the birth of twins, Lucas Hammond and Christopher Arthur on February 11. Lucas weighed 7 lbs. 8-1/2 ozs. and Christopher weighed 6 lbs. 5 ozs.

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