May 30, 1985
FERMI NATIONAL ACCELERATOR LABORATORY

FermiNews

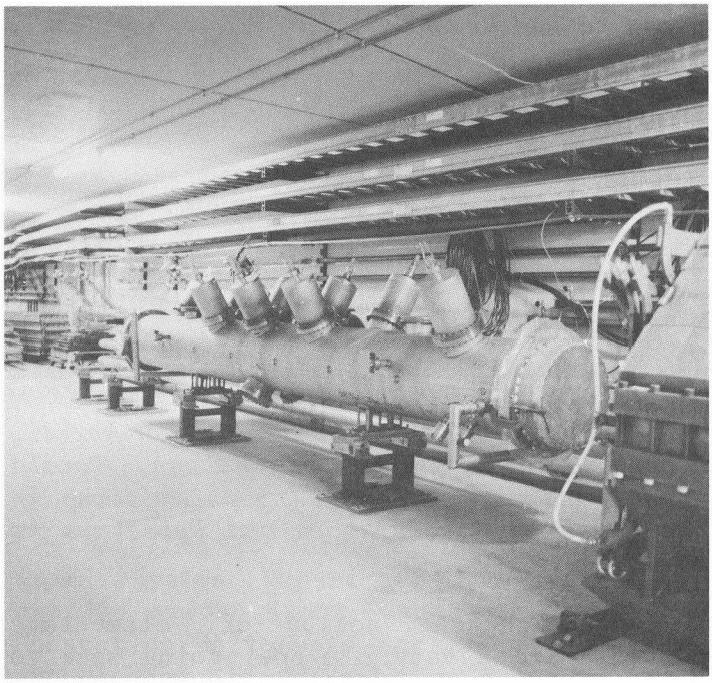
TeV I Antiproton Source Cooldown is Cold Fact

At approximately 4:00 p.m. on Monday, the 20th of May, personnel in the **Tevatron Cryogenics Systems Group** under Claus Rode began withdrawing liquid nitrogen and liquid helium from the transfer line atop the Main-Ring berm. The supercooled liquid coursed into the main TeV I cryogen distribution system in Building 30, and from there liquid nitrogen passed through the Antiproton Source transfer line, across the $\bar{p}$ Ring to the A60 and D10 liquid nitrogen manifolds. Within three hours, the entire TeV I cryogen distribution system, with the exception of the stochastic-cooling tanks, was cooled-down to cryogenic temperatures. In addition, liquid nitrogen and liquid helium were successfully fed through the entire dewar transfer line to the notch-filter dewar manifolds.

A single bottle of hydrogen contains more protons than the Tevatron can accelerate in a century. *Antiprotons*, on the other hand, are much more difficult to obtain. The Antiproton Source at Fermilab makes antiprotons in the same way that they are made all over the Lab: high-energy proton beams hitting a metallic target. The Antiproton Source, however, is special in that it collects the antiprotons in a storage ring known as the Accumulator. These antiprotons are put back into the accelerator traveling in a counterclockwise rotation, in opposition to the clockwise rotation of the protons already in the Tevatron. Eventually, collision occurs between protons and antiprotons at CDF.

A single accelerator cycle cannot produce enough antiprotons to operate the Collider; over a 1,000 pulses are required. Without some special tricks, these 1,000 pulses would not fit in the Accumulator: at each cycle, the beam size must be reduced to make room for the next pulse. The technique used to accomplish this size-reduction is called *stochastic cooling*, and was invented at CERN by Simon van der Meer, who received a Nobel prize for his work.

The relationship between the size-reduction of the beam and the term "cooling" must be rather obscure to non-physicists. It is somewhat ironic that stochastic cooling requires a very real cooling, the kind of cold for which Fermilab has become famous.



Stochastic cooling tank at A60 with liquid nitrogen manifold.

Stochastic cooling is essentially a wide-band electronic feedback system. In order for it to be effective, the thermal noise (which is proportional to temperature) must be reduced by lowering the temperature to the liquid nitrogen range. The system, when complete, will cool approximately 100 ft of pickup and kicker electrodes.

Liquid helium is needed for the superconducting notch filters, which are used to reject unwanted noise. The high quality of the filter is due to the use of a superconducting cable at liquid helium temperature.

Planning for a cryogenic system to supply liquid nitrogen and helium to the Antiproton Source began early in 1983. Engineering and design followed the same approach as the construction of the Tevatron Cryogenic System. Utilizing a satellite refrigerator and a link to the

(cont'd on pg. 3)

History Symposium Provides New Physics Perspectives

by L. M. Brown, Northwestern University

During May 1-4, many distinguished particle physicists, experimentalists and theorists (including nine Nobel Laureates), together with a number of science historians, gathered at Fermilab for the second Fermilab conference on the history of particle physics, entitled **International Symposium on Particle Physics in the 1950s: pions to quarks.**

From left, Luis Alvarez, Ugo Amaldi, Robert Hofstadter, Robert Wilson, Donald Kerst, and Lawrence Jones participating in the Panel on Accelerators and Detectors in the 1950s.

Although the notion of "elementary particle" is a very old one, going back to the ancient Greek and Asian civilizations, the modern field of elementary particle physics began in the 1930s, growing out of studies connected with nuclear physics and the cosmic rays. In fact, until relatively recently, it was generally referred to as "high-energy nuclear physics."

The first Fermilab history symposium was devoted to the period 1930-50, the era of **The Birth of Particle Physics** (which was the title of its proceedings, published by Cambridge University Press in 1983.) During that earlier time, the main source of information about the behavior of nuclear particles came from the cosmic rays (radiation from outer space striking the earth) and from relatively low-energy particle accelerators, by today's standards, like cyclotrons and van de Graaf accelerators. About the middle of the 1950s, machines like the Brookhaven Cosmotron and the Berkeley Bevatron, capable of producing "strange particles" began to change the nature of the field and eventually led to the founding of "big-science" accelerator laboratories like CERN and Fermilab.

The recent symposium dealt with the transitional period, during which the large accelerators gradually took over from the cosmic rays as sources of new particles, while the cosmic rays resumed their earlier role of providing a major window on the universe for astrophysicists. A unique feature of this symposium was that it included as speakers, in addition to physicists, a number of professional science historians, some of whom have themselves been active in particle physics research. They were asked, as were the physicists, to provide documented articles for the symposium volume (again to be published by Cambridge University Press), as well as to give more informal talks at the meeting itself.

Most, if not all, of the 160 participants in Fermilab's International Symposium on the History of Particle Physics in the 1950s pose for the Conference Photograph.

Financial support was provided by the Sloan Foundation and the Argonne Universities Association Trust. Social events included a 1950s party and outdoor buffet at Bj Bjorken's house, and a performance of popular 1950s physics songs by their composer, physicist Arthur Roberts (formerly of Fermilab, now living in Hawaii). Just after the symposium, there was held a one-and-a-half day workshop of the US/Japan collaboration studying the history of particle physics in Japan. That was attended by some of the symposium participants and others, including a number of Japanese users, working at Fermilab.

Both the history symposium and the Japanese workshop were sponsored by Fermilab and Director Leon Lederman. The symposium organizers were Fermilab Historian Lillian Hoddeson, Laurie Brown of Northwestern University, and Max Dresden of the State University of New York at Stony Brook.

(cont'd from pg. 1)
Central Helium Liquifier as a basis, construction of equipment began in early 1984.

The Cryogenic Systems Group in the Accelerator Division provided personnel for the engineering and construction of the cryogenic system. Thanks to the efforts of many people, this project progressed very smoothly; start-up was flawless.

The following is a list of people in charge of specific assignments in the Cryogenic Systems Group. Design and drafting was headed by Harry Barber (retired) and Dave Richardson. Cryogenic component construction, including the transfer line, was done at the Paramount warehouse under the supervision of Fred Walters. When completed, these pieces and the 80' transfer line sections were shipped on special trucks for installation.

Ron Norton and Jim Harder led a team of people who assisted rigging and welding contractors positioning and welding the system together.

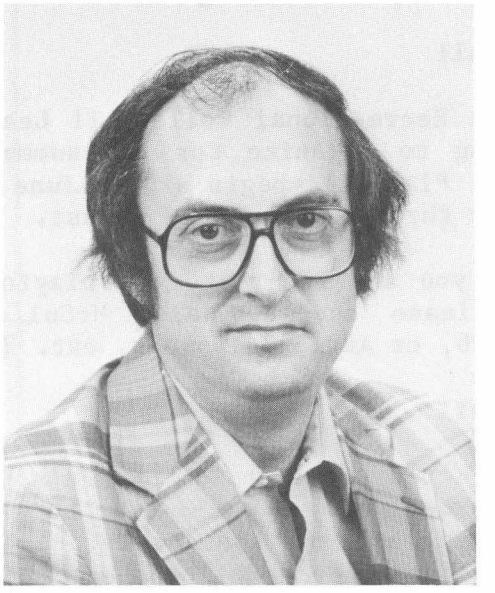
Typical installation of transfer lines in the dead of winter. From left is Michelle Hentges, Manual Santana, Ernie Ernsting, and Tim Richer.

Ernie Ernsting headed-up the effort to leak check, cold shock, insulate, an certify all parts prior to cooldown.

At this point, the electrical and instrumentation people began their hookups. Mike Hentges coordinated installation of the electrical equipment, and Joe Savignano, oversaw the instrumentation needed for operation. Component construction used the services of Clint Vickers (welder/working foreman), and other shop personnel assigned to the Cryogenic Systems Group, to complete the project on-time with a high degree of quality workmanship.

--Bob Ferry and John Marriner

Bardeen Awarded Fellowship



William A. Bardeen of the Theoretical Physics Department was recently awarded a John Simon Guggenheim Memorial Foundation Fellowship for 1985. Bardeen, who began his career at Fermilab in 1975, received this Fellowship for his work concerning the development and application of quantum theory to problems in elementary particle physics.

The Foundation awarded 273 fellowships nationwide in 1985, covering a wide range of activities, from research in physics and mathematics to advanced study in the fine arts. The Foundation's purpose is "to add to the educational, literary, artistic, and scientific power of this country, and also provide for the cause of better international understanding."

Bardeen plans to travel to Kyoto, Japan where he will be a Visiting Scientist at the Research Institute for Fundamental Physics for a period of three months. He will spend the month of December at the Tata Institute for Physics in Bombay, India. Bardeen will spend the remainder of the year abroad in Munich, West Germany where he will have a Visiting Scientist appointment at the Max Planck Institute for Physics.

Congratulations To . . .

40!

Summer Sports Leagues Assembling

Volleyball

The Recreational Volleyball League is beginning to organize for the summer 1985 season. Play will begin around June 1, and continue through the end of August.

If you are interested in playing on a team, please contact Helen McCulloch at ext. 3126, or Angie Velasques, ext. 3740.

Basketball

Join the Fermilab Summer Men's Basketball League! If you would like to play on, or organize a team, contact Tyrone Thomas, ext. 3261 or Helen McCulloch, ext. 3126.

If Measure is Your Pleasure . . .

The distance from your elbow to your wrist equals the length of your foot.

Your body is eight times the height of your head, your shoulders are twice the width of your head, and your foot is equal to the height of your head.

Your wedding ring size is the same as your hat size. (*Although not necessarily in the same units of measure*--ed.)

You can check the fit of new pants without trying them on. With the top of the pants closed and the button snapped, the waistband should just wrap around your neck.

As a rule, the distance between your fingertips, with your arms outstretched at shoulder height, is equal to your height.

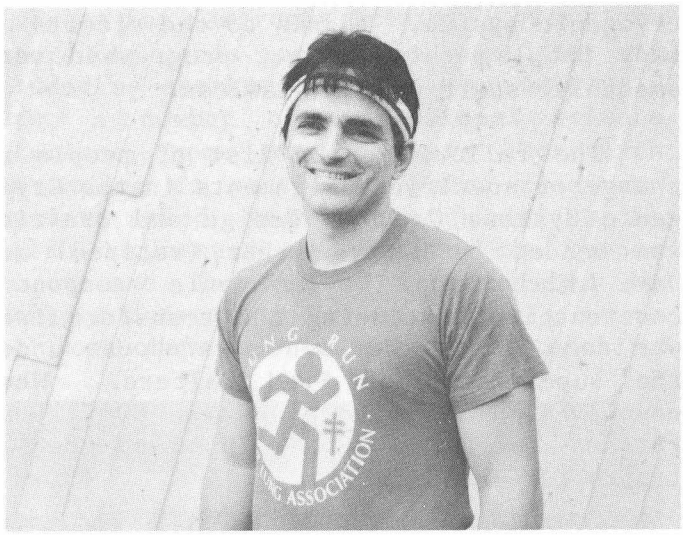
(From *Rules of Thumb*, Houghton, Mifflin)

Editor: R. Fenner; Assoc. editor: S. Winchester
Photography: Fermilab Photo Unit

Fermilab is operated by Universities Research Association, Inc. under contract with the U. S. Department of Energy. Fermilab is published by the Publications Office, P. O. Box 500, Batavia, IL 60510, phone (312) 840-3278.

Marathon is No Sweat for Conlon

On Sunday, April 28, 1985, Steve (RF/Accelerator) Conlon participated in the Lake County Marathon, a 26.2 mile jog from Zion, Illinois, to Ravinia Park in Highland Park, Illinois. Steve's time was 3 hours, 32 minutes, not bad for his first marathon.



Steve Conlon

"I'd say it was interesting, but I wouldn't call it fun...it was strange to see people falling flat on their faces right in front of you."

A week before the marathon, Steve ran 18 miles--the farthest distance he had ever run.

To keep himself in top condition, Steve rides his bicycle to work and back every day, runs around the Main-Ring road during his lunch hour every afternoon, and canoes every night. With a schedule like that, it's a wonder he can drag himself to work in the morning!

Another employee who participated in the Lake County Marathon was Pat (Laboratory Services) Moyer who ran the half distance: from Zion to Lake Bluff. Pat ran this 13.1 miles stretch in 1 hour, 49 minutes.

--S. Winchester

With a cloud of dust and a hearty "Ohmygod why am I doing this?" the **7th Annual Slow Run with the Director** will thunder away from the starting line at 7:00 a.m., Saturday, June 1. Finishers will get a free breakfast. Nonfinishers won't care. Be there!