

FERMILAB NEWS

 Fermi National Accelerator Laboratory

Operated by Universities Research Association Inc.
Under Contract with the United States Department of Energy

Vol. 3, No. 44

October 30, 1980

FERMILAB ACHIEVES ITS FIRST ELECTRON COOLING

For the first time at Fermilab, a hot proton beam has been cooled by a beam of cool electrons - a process known as electron cooling.

This first experiment was done at a proton energy of 115 MeV, which is the highest energy electron cooling achieved anywhere, reported Don Young, head of the Colliding Beams Department. A monumental achievement, it becomes another major milestone to Fermilab's credit as the Laboratory moves toward the storage of antiprotons, a necessary requirement for proton-antiproton colliding beams.

The first electron cooling came at 5:35 a.m. on Oct. 17. Scientists working on the project are exultant because it clearly is an important accomplishment in the necessary development of an antiproton source. It comes on the heels of the successful stochastic cooling that Fermilab achieved with assistance from collaborators at Lawrence Berkeley Laboratory earlier this year on Feb. 9.

Young and Fred Mills, Colliding Beams Department deputy head, extended their thanks to the many people who over the years contributed to this success. They particularly pointed out the efforts of the Internal Target Group (Accelerator Division) led by Peter McIntyre. "They were responsible for the design and construction of the electron cooling system," said Young. "It's a very complicated and difficult system and represents a great extension of the technology done before this time." The electron cooling system is installed in the cooling ring that was constructed and is operated by the Colliding Beams Department.

The cooling ring is located in the blue elliptical building west of the Booster-West Gallery. This 200 MeV storage ring has two long straight sections. The east section contains equipment used principally for stochastic cooling; the west section holds the equipment used in electron cooling.



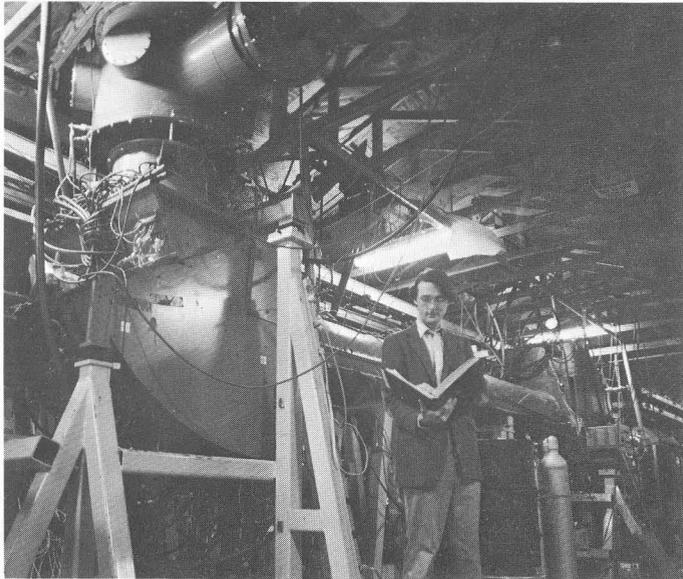
All smiles, of course. It was a time to celebrate in the colliding beams control room shortly after an electron system was used to cool a hot proton beam. Seated from left Russ Huson, Fred Mills, Don Young and Peter McIntyre. Standing from left Jim MacLachlan, Hang Lai, Bill Kells and Curt Canada (a graduate student from the University of Wisconsin).

Up to the present time, electron cooling has been demonstrated at two other laboratories, first at Novosibirsk and later at CERN. The electron cooling conducted at CERN about a year ago was run at 50 MeV. The electron cooling system at Novosibirsk ran in the energy range of around 65 to 110 MeV, with a current of about one-half ampere. Not only does the Fermilab electron cooling system have a higher energy than these systems, but it has a greater electron current capability, up to 7 amperes. In achieving cooling under these conditions, new space charge problems were encountered that were not seen in the earlier experiments.

Cooling is a necessary technique in the accumulation of antiprotons, which are formed by bombarding a target with high energy protons. At Fermilab, a beam of 80 GeV protons from the Main Ring has been proposed. The antiprotons emerge from the target with a large range of transverse and longitudinal momenta, and thus only a fraction of the total

(Continued on page 2)

(Continued from page 1)



Peter McIntyre examines a data book. Behind him is the electron beam system. Cooling of the proton beam is accomplished along the horizontal segment.

yield can be accommodated in a storage ring of reasonable aperture. The anti-proton beam also has very sparse density.

In the electron cooling process, excess transverse and longitudinal momentum of the antiprotons are transferred to the electrons until the two beams reach equilibrium. The antiproton beam thus is cooled by heating the cooler electron beam. This allows the antiproton beam to be reduced in size. Successive pulses of the antiproton beam can then be accumulated in the storage ring for long periods of time.

An alternate method of cooling is called stochastic cooling. The first stochastic cooling at Fermilab was performed on Feb. 9 of this year. The experiments are continuing. Stochastic cooling is somewhat complementary to electron cooling. Stochastic momentum cooling is effective for high energy, large momentum spread beams, and electron cooling is most effective for relatively cool beams at low energy.

Furthermore, electron cooling works equally well for transverse and longitudinal beam dimensions. Both approaches require different technologies, and Fermilab will continue its investigation of both systems. "It is essential that Fermilab have the most advanced cooling systems available for future projects," said Young.

Cooling is an important part of the Tevatron I project, which has the goal of providing the capability of sustained

operation of the superconducting magnet ring at 1 TeV and proton-antiproton colliding beams at up to 2 TeV center-of-mass. These enormously high energy levels are expected to provide physicists with the deepest peek ever into the nature of matter and undoubtedly unveil a whole range of new phenomena.

The research and development effort on Tevatron I is a collaboration between Fermilab, Lawrence Berkeley Laboratory, University of Wisconsin and the Institute of Nuclear Physics at Novosibirsk, USSR. In the electron cooling experiment, the Russian collaborators were helpful in the design and early testing of the system. In addition, the design of the gun and electron collector systems were carried out in collaboration with scientists from Stanford Linear Accelerator Center who constructed the gun and collector components in their klystron facility.

This milestone of electron cooling is the culmination of work begun in early 1976, when Fermilab scientists saw the necessity of entering a new domain of energy levels - those in the trillions of electron volts.

"This large step will surely bring forth new and exciting knowledge," Young concluded.

* * * * *

MEDICAL SPORTS WRITER
TO SPEAK AT FERMILAB

Dr. Richard H. Dominguez, author of "The Complete Book of Sports Medicine," will speak on his favorite subject - sports medicine - Nov. 3 at Fermilab.

Open to all employees and users, his talk will begin at 11:30 a.m. in Curia II, WH2SW. It will last about an hour with a question and answer session afterwards. He is the guest of the Fermilab Medical Office.

Dr. Charles A. Lang, Fermilab physician, explained that many employees are sports enthusiasts and "would certainly benefit from what Dr. Dominguez has to say. That's why we asked him to speak here."

According to Dr. Lang, this will be the first of a series of talks by medical and other experts on topics relevant to employees' health and safety.

* * * * *

BRAKES PUT ON NON-BUSINESS MAIL

Fermilab is cracking down on unsolicited, non-business materials that in the past have been sent through the Laboratory's internal mail service.

Two recent examples are a chain letter and a church-affiliated notice. "These were evidently put into the mail system as a means of gaining wide distribution throughout the Laboratory," said Carolyn Hines, manager of Communications Services. "Not only is this a misuse of the mail service, but materials such as these are considered by many to be offensive."

She pointed out that mailroom personnel now handle more than 4,000 pieces of mail each day--the maximum that can be handled efficiently. "Therefore, mailroom personnel have been instructed not to accept any internal mail that will be distributed to all employees or to all mail stations without signature approval of a division/section head," said Hines. "The mailroom also will require the name of the sender as well as the name of the person who approved the mailing.

"Without this approval and verification, the mailing will not be sent. We need to do all we can to reduce the volume of mail, especially during the approaching holiday season."

Hines can be reached at Ext. 3788, mail station 215, for more information.

* * * * *

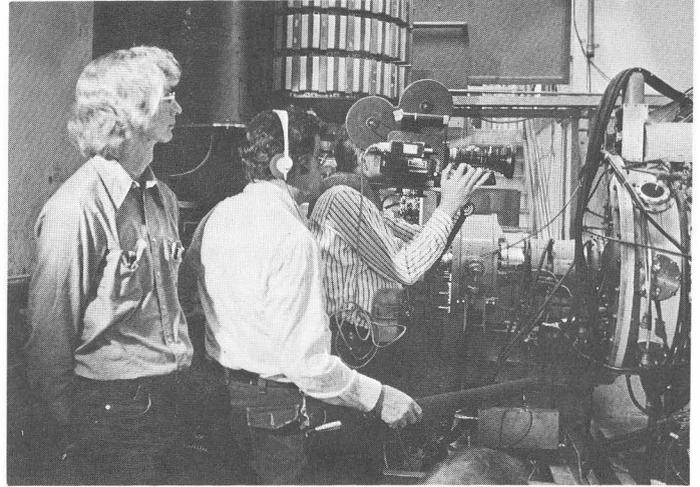
CHEZ LEON MENUS

Tuesday, Nov. 4, 7 p.m., \$10: "Fin 'n Feather" special; oysters casino; romaine and breast of chicken salad; dijon duck with scampi sauce diablo; potato souffle; minted peas w/mushrooms; panama crepes/flambe.

Wednesday, Nov. 5, 12:30 p.m., \$6: Featured item-oysters rockefeller, delmonico salad; breast of chicken w/scampi; scallops in lobster sauce; spinach souffle; potato rosemary; french chocolate mousse. Alternate suggestions: filet mignon-mushroom saute; loin chops of lamb/mint sauce; sauteed scampi, sauce diablo; boneless strip steak-natural juices.

Thursday, Nov. 6, 7 p.m., \$10: Lucas eye or grapefruit kirsch flambe; Fermi salad greens; steak dianne; duchess potato; asparagus hollandaise; white chocolate mousse.

* * * * *



An American Broadcasting Company film crew photographs a part of the Linac for an upcoming Good Morning America show with David Hartman. Conducting the crew through the facility was Marv Olson (left), an operator with the Main Control Room. The crew's assignment was to take shots of the Neutron Therapy Facility in action for Hartman's "Medical Breakthrough" feature. The crew interviewed Dr. Frank Hendrickson, head of the NTF, and showed him treating a patient.

* * * * *

SPECIAL MEETING ABOUT BICYCLES

Fermilab will hold a special meeting Nov. 5 open to all employees and users who ride bicycles on the site.

The session will begin at 11 a.m. in Wilson Hall auditorium and is expected to last for about one hour. Participating in this meeting will be representatives from Site Services, Security, Roads and Grounds, Safety Section, Users Office and others.

The objective is to take a look at bicycle use at Fermilab. A limited amount of funds are available to improve and extend the bicycle paths. Fermilab wants recommendations from bicycle riders not only about the paths but also about other steps the Laboratory could take to make bicycle riding on the site a safer, more comfortable and more pleasurable experience.

Discussions such as these will help the Laboratory decide what the present and future priorities with regard to bicycles should be. Among the topics that will be discussed will be striping and marking, condition and use of the route as well as its extension.

* * * * *

CAFETERIA KITCHEN TO BE REMODELED

The Wilson Hall cafeteria kitchen will be remodeled and will have a new dish machine installed. The work will begin Oct. 31 and is expected to end Nov. 7. During this time, the cafeteria will use paper service. "Your indulgence will be appreciated, and we apologize for any inconvenience this may cause," and Peggy McAuliff, assistant cafeteria manager.

* * * * *

FERMILAB ON NATIONAL GEOGRAPHIC SPECIAL

Fermilab will be featured during one of the segments of the National Geographic Society special presentation of "The Invisible World."

The show will be aired Nov. 23 at 7 p.m. on WTTW-TV, channel 11, Chicago. The special, a rerun, studies phenomena not normally seen with the unaided eye. This includes subatomic particles.

* * * * *

EMPLOYEES SHARE KNOWLEDGE ABOUT FERMILAB

Fermilab employees who assisted the Public Information Office during September in telling groups and organizations about Fermilab and its many activities include Steve Bracker, Dave Cosgrove, Larry Coulson, Akihiro Maki, Thornton Murphy and Gerry Tool. Speaking before groups at meetings held outside the Laboratory were Frank Hendrickson and Bracker.

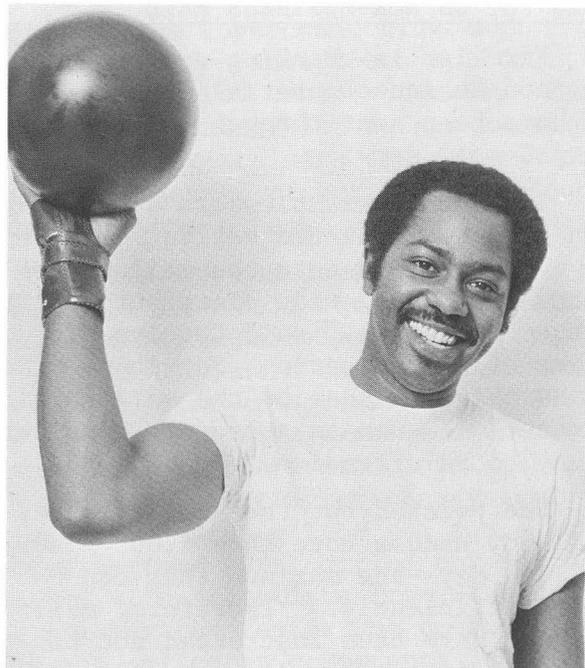
* * * * *

NEXT COLLOQUIUM SPEAKER

Prof. William A. Fowler of the California Institute of Technology will speak Nov. 5 at Fermilab about "Nucleosynthesis in Supernovae."

His Physics Colloquium talk will begin at 4 p.m. in Wilson Hall auditorium. In this talk, Fowler will discuss the role of nuclear processes in the implosion-explosion mechanism for supernovae. The detection of line x-rays from supernova remnants by the Einstein Observatory satellite shows that intermediate mass elements are produced, Fowler explained. He is the guest of the Physics Colloquium Committee.

* * * * *



...Ed Justice...

GREAT BOWLING FOR ED JUSTICE

It was a glorious time for Ed Justice, that evening of Monday, Oct. 13.

He bowled a 702 series, with individual games of 243, 235 and 224. At the end of that series, his average jumped to 194. Ed is a member of the Fermilab Monday night Mixed Bowling League, whose members bowl in Warrenville. And the team he's on-- Full Force--was in first place with 27 games won and 15 lost on Oct. 13.

His outstanding series qualifies him for an award and recognition from the American Bowling Congress. The league has 12 teams, each with five bowlers.

* * * * *

SPECIAL NOTICE ABOUT WELDING

No welding, brazing and cutting operations on the Fermilab site can be done until a properly signed hazardous operations permit has been issued, said Capt. Fred Cload of the Fermilab Fire Department. The "Fermilab Safety Handbook" spells this out precisely on pages 46 and 47, he also said.

The Fire Department is now the proper issuing agency for these permits. To obtain a permit and for additional information about this policy, contact Cload at Ext. 3428.

* * * * *