

# The Village Voice



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## TOTAL CROSS SECTION EXPERIMENT ANNOUNCES SIGNIFICANT RESULTS



*...Total cross section experimenters (L-R): R.L. Cool, R. Rubinstein, P.O. Mazur, A.A. Wehmann, T.F. Kycia, I-H. Chiang, W.F. Baker, K.P. Pretzl, O. Fackler. Not present when the photo was taken were: A.S. Carroll, D.P. Eartly, G. Giacomelli, P.F.M. Koehler, K.K. Li, P. Mockett and D.C. Rahm...*

The results of an important experiment at the FermiLab were presented at the XVII Conference on High Energy Physics that opened in London, England on July 2nd. (The XVI such conference was held here at the Laboratory and the University of Chicago in September, 1972.) The experimental results, considered to be a major advance in high energy physics, were described by the spokesmen for the FermiLab total cross section experiment at a press conference held in New York City on Thursday, June 27. Dr. Winslow F. Baker of the Physics Department of FermiLab, Dr. Thaddeus F. Kycia of Brookhaven National Laboratory, and Dr. Rodney L. Cool of The Rockefeller University described for the press the techniques they used to achieve the new understanding of the behavior of sub-nuclear particles at high energies in the experiment they have run in the M-1-W beam line of the FermiLab Meson Area in recent months.

Win Baker, speaking on behalf of the entire experimental group, this week expressed the group's appreciation for the concerted efforts of many people who worked with the experimenters to complete the experimental work in time to report the significant results at the London conference. "We especially want to thank the Cryogenics group, under Dr. Ron Fast and Mike Otavka, for their devoted around-the-clock herculean efforts. We thank the entire staff of the Meson Department -- in particular Tony Glowacki, the engineer who supervised the installation of the experiment. Our thanks for help go to our technicians -- especially Hoshang Vaid, as well as Hugh Christ, Mark Kibilko, and Ron Miksa.

"Cordon Kerns played a key role in designing some of the electronics. Chuck Ankenbrandt did much of the programming for the on-line PDP 15 computer.

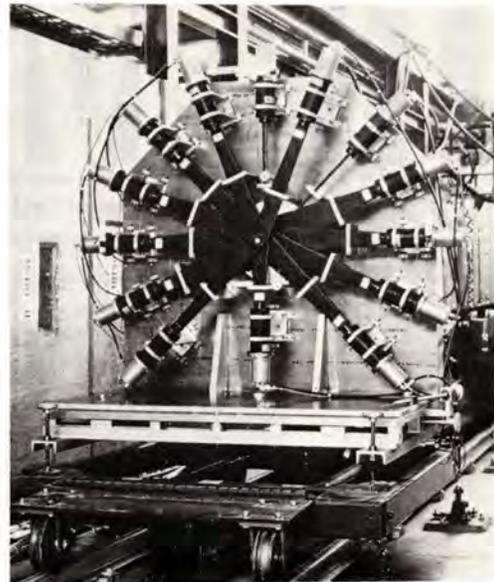
"Not only do physicists from other institutions participate in our experiments, but they are supported by dedicated teams of technicians, engineers, and programmers. In this case, in addi-

(Continued on Page 2)

## TOTAL CROSS SECTION EXPERIMENT (Continued)



*...FermiLab Meson Experimental Area, home of cross section experiment...*



*...Transmission counters used in measuring total cross sections...*

tion to our FermiLab help, much assistance was given by staffs of the Brookhaven National Laboratory and Rockefeller University."

The experiment studied the probabilities of interactions occurring when pi mesons, K mesons, protons and antiprotons coming down the beam line at 50-200 BeV are fired at targets of protons and deuterons. These interaction probabilities are referred to as "total cross sections." Total cross section data are considered some of the most important information in high energy physics. The behavior of particles when they meet other particles and the probability of their interacting with those particles can give important clues to a description of the particles and the worlds in which they travel deep inside the nucleus of the atom.

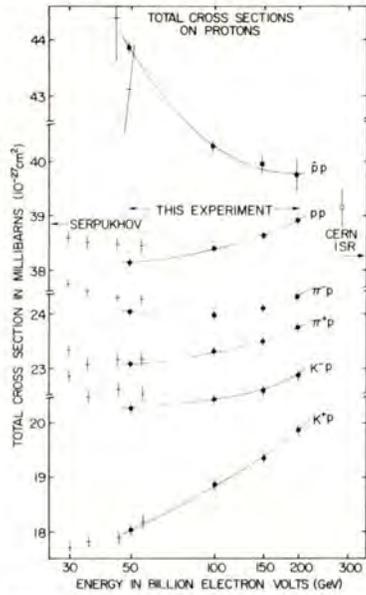
The experiment shows that, in nearly all instances studied, the proton particle system grows in size, or interaction probability, for energies increasing from 50-200 BeV. As the energy increases, protons are more likely to collide with other particles. This is a sharp departure from much previous data which indicated that the total cross section would be large at low energies and decrease at high energies or remain constant.

Dr. Baker explains, "Until recently, we would have expected that the faster two particles pass each other, the less likely they are to interact. However, our experiment shows that the more energetic the particles are, the more likely they are to interact -- and that seems to be true for nearly all the strongly interacting particles."

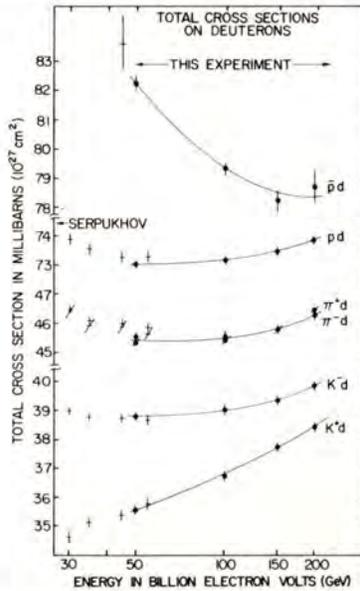
The phenomenon yields clues to the behavior of the strong force, one of the family of four major forces in nature. At higher energies, the strong interactions among different particles become equal, as Dr. Baker notes. Dr. Ben Lee of the FermiLab Theoretical Physics Department illustrates the situation this way: "In the case of two children, one two years old and the other one year old - one year difference in age - the first is twice as old as the second. But at ages 21 and 20, there is no appreciable difference in the ages of the same two children. This is what we see in this experiment. This is what we have learned about the behavior of the strong force as we advance to higher energies."

The phenomenon of cross sections rising with energy was first suggested in 1971 by scientists working with a beam of positively charged K mesons at energies up to 50 BeV at the U.S.S.R. Serpukhov accelerator. In 1973, western European scientists working at the European Center for Nuclear Research (CERN) near Geneva, Switzerland announced an increase in cross sections in proton-proton collisions. CERN scientists were limited to the study of proton-proton collisions by the nature of the Intersecting Storage Ring accelerator, in which two oppositely-directed beams of protons collide with each other, although they were able to reach an equivalent laboratory energy of 2000 BeV. In the Meson Area at the FermiLab, 300 BeV protons strike a stationary nuclear target. Intense beams of many different sub-nuclear particles with energies up to 300

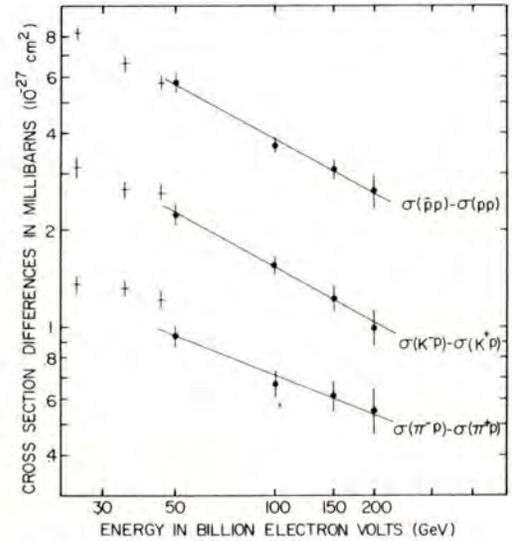
## TOTAL CROSS SECTION EXPERIMENT (Continued)



...New total cross section data show a general rise with increasing energy for various incident particles on protons. Additional proton-proton cross section measurements made at the CERN-ISR lie off the figure to the right...



...Total cross sections on deuterons show same general energy behavior as on protons. Only for incident antiprotons does the cross section fail to rise in this energy range; however, it has leveled off perhaps in anticipation of rising at even higher energies...



...The differences between particle and antiparticle cross sections are decreasing with increasing energy. This is in agreement with the Pomeranchuk theorem which states that the differences become zero at infinite energy...

BeV emerge from this target. Because of this, a large number of precise measurements of many different interactions is possible in the FermiLab experiment. Particle beams used at the FermiLab include protons, antiprotons, positively and negatively charged pi mesons, and positive-ly and negatively charged K mesons.

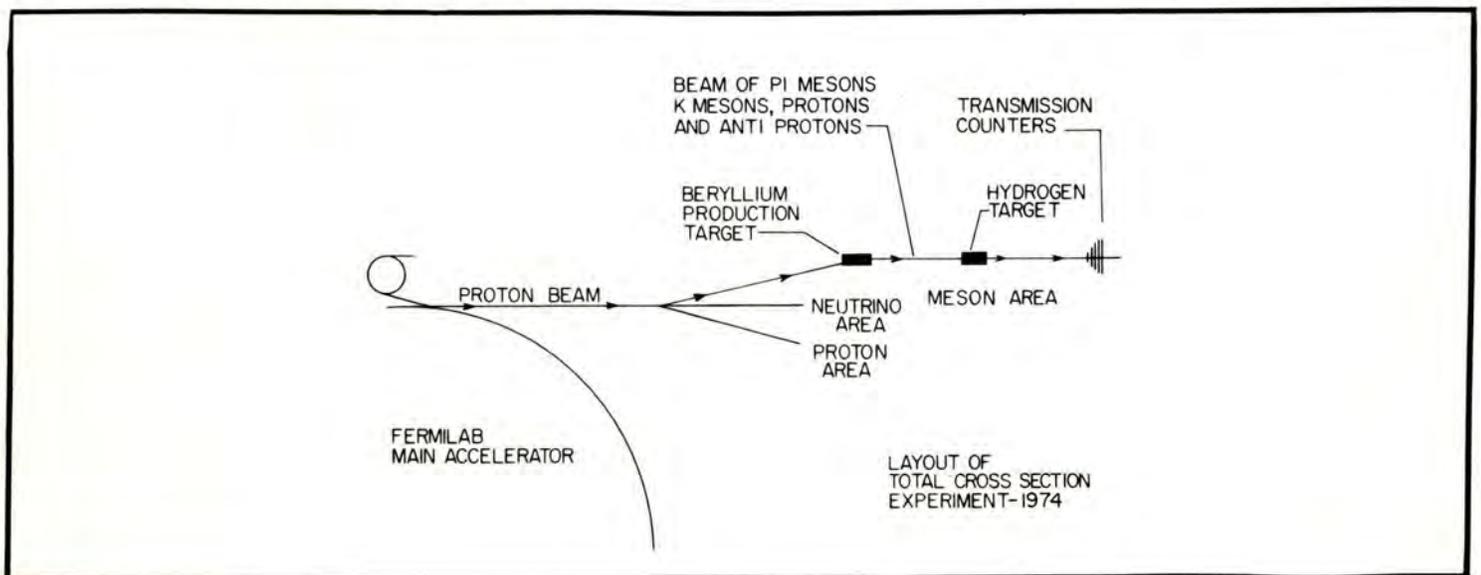
In addition to Baker, Cool, and Kycia, other members of the total cross section experiment and authors of the paper to be published in the journals of the American Physical Society are:

From the FermiLab: David P. Eartly; Giorgio Giacomelli (from the Institute of Physics, Padova, Italy); Peter F.M. Koehler; Klaus P. Pretzl (now at the Max Planck Institute for Physics and Astrophysics in Munich, Germany); Roy Rubinstein and Alan A. Wehmann.

From the Brookhaven National Laboratory: Alan S. Carroll, I.-Hung Chiang, Kelvin K. Li, Peter O. Mazur, Paul M. Mockett (now at the University of Washington) and David C. Rahm.

Also from The Rockefeller University was Orrin D. Fackler.

The total cross section behavior was predicted in a theory put forth by H. Cheng (Massachusetts Institute of Technology), James K. Walker of the FermiLab, and T.T. Wu (Harvard).



SATURDAY, JULY 13  
TWO BIG EVENTS AT THE FERMILAB

First FermiLab Canoe Race

Your style may be the winner on the fifteen portages of the first race in the Main Ring Cooling Ponds on Saturday, July 13. The big paddle will start at 11 a.m. The race is open to employees and visiting experimenters, the more the merrier. The team of Tony Salvaggio and Chuck Carmichael has signed up. Can Jackie Gifford and John Barry beat them? Canoeists and portage supervisors are needed. Call Larry Allen, Ext. 3721, or Helen Ecker, Ext. 3393, before July 8 to register.

NALREC Luau

A Hawaiian Buffet Dinner will be served from 7:30 p.m. to 1:00 a.m. on Saturday, July 13, at the Village Barn. Lamb, beef, and pork will be roasted on an open fire, carved to order. Kalhau and her Hawaiian review will perform during the evening. All visiting experimenters and employees are invited. There is no charge for this NALREC-sponsored evening.

SECOND SESSION SWIMMING LESSONS

The second session of swimming lessons at the FermiLab pool will begin on Monday, July 15. Registration, placement and payment of fees will begin at the pool at 9:00 a.m. Beginners will have 15 one-hour lessons on Mondays, Wednesdays and Fridays from 10:00 to 11:00 a.m. Intermediate swimmers will have ten lessons of 1½ hours each on Tuesdays and Thursdays. Fees are \$15.00 for both beginners and intermediate. For further information, call Eric Jarzab, Ext. 3398.

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CLASSIFIED ADS

FOR SALE - 1968 Buick Skylark, 6 cyl., 2 door, p.s, gold w/blk. vinyl top, new carb., clean interior, Diehard bat., runs good, \$750. Call Doris Ferrell, Ext. 3211 or 896-8679.

FOR SALE - 1956 Belvedere Plymouth, excel. cond., automatic, pwr. brakes, new bat., new tune-up, gd. tires, \$400. May be seen at Safety Office - Bob Adams, Ext. 3580.

FOR SALE - Sears 18,000 BTU Air Cond., used 2 seasons, \$135 or best offer; a 1972 Honda C1 100, low mil., \$325 or best offer. Call Roy Mraz, Ext. 3734.

FOR SALE - Well cared for 1971 Honda CB-350, \$600. Call Bob Sorber, Ext. 3165.

FOR SALE - Home grown peas in the pod; a Ford 8-N Tractor, 3 pt. hitch, 2 row cultivator, P.T.O. fluid in rear tires, gd. cond. HINES FARM (Carolyn Hines), 1st farm south of Rt. 56 on Eola Rd., 357-3847.

FOR SALE - New Sears/Eska 5.5 hp. outboard motor w/auxiliary gas tank, \$150 FIRM. Call George Zakhar, 969-7377.

FOR SALE - A small Hobby Shop full of RC planes, boats, radios & accessories, price negotiable; a Citizens Band Radio Station, a base that flat "gets out" & 2 mobiles (base & 1 mobile 23 ch, 2nd mobile, 6 ch), no frills, all less than 8 mos. old., \$500 FIRM; a 3 watt-3 channel Walkie-Talkie, \$60. Call Dan Wagler, Ext. 3064 or 231-9506.

FOR SALE - AKC Alaskan Malamute, champion lines, excel. breeder & money maker, female 2½ years, gd. with children, \$150 or best offer. Call Greg Lawrence, Ext. 3677.

TO GIVE AWAY - 12 wk. Beagle/Basset puppy. Call L. Wahl, Ext. 3734 or 897-5517 after 6 p.m.

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