



# The Beam Line



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## Hybrid 40-inch Bubble Chamber Studies 'Inelastic Muon-Proton Scattering'

(Ed. Note: In the previous BEAM LINE, the operation of SLAC's 40-inch bubble chamber in the "hybrid" mode was well described by Gordon Bowden. This article will deal with some of the results of the experiment.)

Some preliminary results of BC-42, the study of inelastic muon-proton scattering conducted in SLAC's 40-inch bubble chamber, were reported in September at the XVI International Conference on High Energy Physics at Chicago and Batavia. The physicists involved in the experiment were J. Ballam, E. Bloom, J. Carroll, G. Chadwick, R. Cottrell, M. Della Negra, H. DeStaabler, L. Gershwin, L. Keller, M. Mestayer, S. Stein, K. Moffett, and C. Prescott.

The experiment, first of its kind anywhere, produced some mind-boggling statistics. A total of about three billion negative muons were delivered to the hybrid chamber, resulting in 30 million chamber expansions. Of these, 100,000 resulted in pictures being taken. These pictures, through the tireless efforts of virtually the entire scanning group, resulted in 5,000 events, of which 4,000 were the desired inelastic scatters -- those in which new particles are produced. Thus, only about one beam muon in a million inelastically-scattered, providing graphic proof that triggered operation of the chamber was the only way to go on this kind of an experiment.

Some more numbers: at 100 mu's per pulse, there was 1 picture per 320 expansions and one event per 3600 expansions. Since the chamber ran most of the time at 10 expansions per second, this translates into 120 pictures per hour (one every 20 seconds), with 10 events per hour (one every six minutes).

In the old days (say, 1965) a typical untriggered bubble chamber experiment would take at most

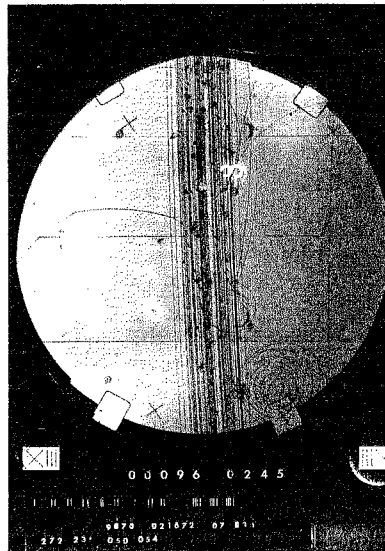
one million pictures with 15 incident beam particles per pulse. If this had been done in BC-42, only a dozen interesting events would have resulted.

The results reported in Batavia resulted from the analysis of about half the data (45,000 pictures). The pictures were scanned twice; three times when ambiguous. The physicists estimate the overall scanning efficiency to be 99 percent.

The results show, as would be expected, that the inelastic muon-proton total cross section (a measure of the interaction probability) is consistent with inelastic electron-proton scattering data as obtained from spectrometer experiments in End Station A. Also, as would be expected, the probabilities for producing rho and omega mesons were consistent with previously-done photoproduction and electroproduction experiments. (As the names imply, photoproduction and electroproduction refer to production using beams of photons and electrons, respectively).

One new effect seen in the experiment was that the number of strongly-interacting particles (hadrons, as they're called, i.e. particles interacting via the nuclear force) produced seemed to decrease as the value of the momentum transferred by the muon to the target proton increased. The significance of this effect, H. DeStaabler told us, is not yet understood.

Other data was obtained which, at this point, doesn't lend itself to a simple interpretation. Ultimately, however, the data (along with that to be gained in E-72, an inelastic muon-proton scattering experiment to be completed this summer in SLAC's streamer chamber by a SLAC Group D-U, S. Santa Cruz collaboration) should shed new light on the inner structure of neutrons and protons by enlarging on the data obtained in inelastic electron scattering in End Station A over the past few years.



Typical event photograph from the experiment.

## Riggers Receive New Crane

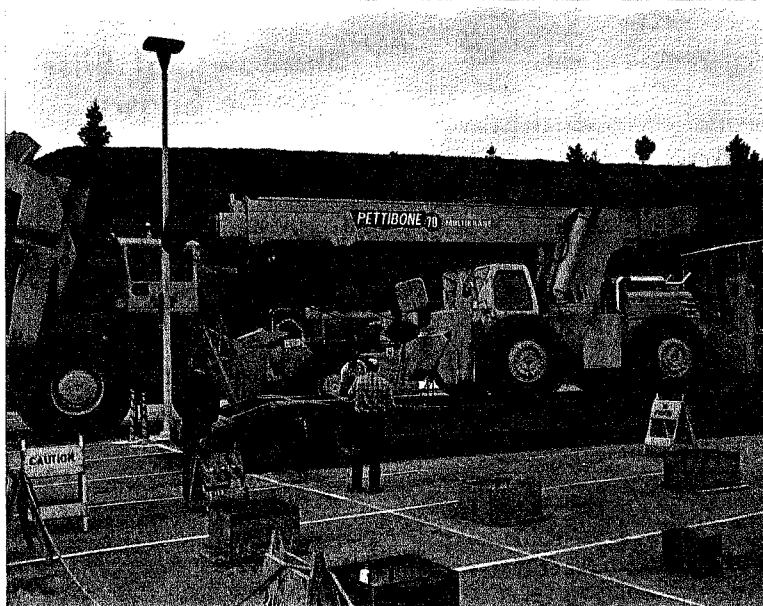
SLAC's Rigging Crew recently celebrated a new addition. (To their family of high-powered diesel moving equipment, that is!)

The new acquisition is a Pettibone 35-ton capacity, hydraulic "multikrane" delivered on January 24 to SLAC. It contributes to an arsenal of heavy moving equipment, including a 12.5-ton Pettibone crane, 15-ton Liftall fork truck (recognizable by its bright red color) and the 40-ton-capacity Le Tourneau hoist-fork lift (which, much to the chagrin of PIO guides, attracts more attention from visitors to SLAC than almost any other piece of equipment on site).

Tex Couch, Foreman of the Rigging Crew,

explained that he had been advocating the acquisition of the crane since 1969. He argued, ultimately successfully, that the new crane's longer boom and increased lifting capacity would reduce the time he and his crew spent "jury rigging" other equipment. Of course, the extra time spent was expensive. So, a contract for purchase of the crane was entered into on September 20, 1972.

The new crane was put right to work. One of its first jobs was done in conjunction with its little brother, the 12.5-ton crane, and involved putting the muon chambers for the new SPEAR detector into position - a job calling for an accuracy of one thirty-second of an inch in placement.



New 35-ton crane on its arrival at SLAC, January 24. In the foreground, Jim Nolan (left), working foreman of the Rigging Crew and Tex Couch, foreman of the transportation company which delivered the crane.

## "Action Photos" SLAC - Emergency



Captain Leon Leonard (left) and Bruce Wood demonstrate a heart-lung resuscitator on their favorite victim, Resucil Anne.



Jack Miljan at the SLAC communication center in the Fire Department.

# Summary of Feb 26 'All Hands Talk'

# Job Openings

Several members of the SLAC staff have asked that the substance for Dr. Panofsky's February 26 talk be printed. What follows is a brief abstract of that talk.

The first part of the talk dealt with program decisions in view of SLAC's anticipated Fiscal Year 1974 10 percent purchasing power decrease (three percent being an actual dollar out, seven percent representing inflation).

Those program areas not to be cut include (1) SPEAR; (2) the Large Aperture Solenoid Spectrometer (LASS) project; (3) commitments made to experimental users; (4) accelerator research and development efforts not involving hardware construction aimed toward the future, including the Recirculating Linear Accelerator and advanced storage ring projects; and (5) maintaining the number of operating shifts at not less than 50 percent of maximum, or 430 shifts.

This means that other program areas will have to be reduced by more than 10 percent. Decisions made in other areas: (1) accelerator improvements will be reduced by roughly one-half; (2) there will be a virtual moratorium on beam line changes; (3) operating personnel on all shifts will be thinned out; (4) power consumption will be restricted, in part by not having more than six simultaneous beams running; (5) target area support to experimental users will be reduced; (6) bubble chamber operation ability will be sharply curtailed, including a proposal (subject to the reaction of our user community) to withdraw the 82-inch chamber from operation by January 1974; (7) the Data Analysis Group will be reduced by about 20 percent; (8) that part of RLA and advanced storage ring development involving hardware construction will be phased out; (9) there will be some reduction in Library, Personnel, and Business Service functions and services; and (10) enrollment in SLAC's training programs is being frozen at current levels.

The second part of the talk dealt with the relation of the program decisions to staff reduction plans. 140 man-years are to be saved during the year from July 1, 1973 to June 30, 1974 by reduction in contract personnel, normal attrition, limitations of raises, and layoffs. It was anticipated

that layoffs plus attrition would reduce SLAC manpower by 90 by July 1, 1973, meaning 80 would have to be laid off by July 1, 1973. Dr. Panofsky announced that the number of net involuntary separations would probably be closer to 70 since it appears attrition during this period will be greater than 10. Attrition during the period July 1, 1973-June 30, 1974 is expected to complete the needed personnel reduction.

Under these circumstances, all personnel on "trial employment" status must, by University regulation, be sent layoff notices. However, since some jobs now held by trial period employees are essential, it is planned to post about 10 such positions as open to all SLAC applicants. Those employees on lay-off notice, including the trial period employees, will have preference for these jobs. Thus, the 80 lay-off notices will result in roughly 70 "net" involuntary departures.

Dr. Panofsky next addressed himself to the question of why attrition itself cannot be expected to solve SLAC manpower problems. In 1972, he noted, 81 people on regular appointment left, while 57 more were hired from outside, representing a turnover rate of 7.6 percent but an attrition rate of only 2.3 percent. Those leaving SLAC during 1972 were mostly from the less skilled occupations. Since these jobs are as essential to SLAC operation as any other and since they are least likely to attract in-house applicants, replacement from outside was mandatory. Therefore, one cannot expect attrition to exceed one-third of turnover, and "outside" rehires is necessary two-thirds of the time. Even if none of the 40 or so voluntary departures expected between January 1 and June 30 of this year (based on the 1972 experience) were replaced, a reduction of only 40 people by June 30 would result, which would not solve our problem. But, as explained above, many of the voluntary departures must be filled if SLAC is to remain viable.

The talk ended with Dr. Panofsky noting that although SLAC's financial picture is difficult and may continue that way for some time, the laboratory's scientific promise and long-range productivity look very bright.

## Slac at Particle Accelerator Conference

The 1973 Particle Accelerator Conference, held March 5-7 at the Sheraton-Palace Hotel in San Francisco, should be concluding as this issue of the BEAM LINE appears.

Under joint sponsorship by SLAC and LBL, some 700 physicists from all over the world are expected to attend the conference, whose purpose is to provide a channel of communication for accelerator scientists and engineers and for persons concerned with applications of accelerators.

E. J. Lofgren, of LBL, is Conference Chairman, while SLAC's R. B. Neal chairs the Program Committee, of which SLAC's G. Loew is a member. Doug Dupen and Ruth Nelson, Personnel, have been handling many of the administrative details associated with the program, registration, etc., as have Ted Kirksey and Howard Smith of LBL's Technical Information Department and Anita Sando, Dr. Lofgren's secretary. SLAC's Willie Johnson, Accelerator Electronics, and Steve Kociol (PIO) are coordinating audiovisuals with Berkeley's Al Reuss. Alan Wilmsunder has built a novel "session in progress" indicator, which will be the subject of a later story.

The program consists of 29 invited papers, 271 contributed papers, and one panel discussion. All accepted papers will be published in the Proceedings of the Conference.

## AEC WOMAN

(Ed. Note: This article was taken in part from the February 9, 1973, edition of the Brookhaven Bulletin, which in turn received its information from an article in Nucleonic News.)

On Tuesday, February 6, the White House announced the appointment of Dixy Lee Ray, 58, as the next chairperson of the Atomic Energy Commission.

Ms. Ray, a marine biologist from Washington State, was named to the commission in 1972. She has been known for her personal colorfulness. She lives in a trailer on a rural Maryland farm. She keeps her two dogs with her at nearly all times and they sleep behind her desk at the AEC. It is reported that only on very formal occasions, such as appearance before the Joint Committee on Atomic Energy or visits to the White House, that she leaves her dogs.

Ms. Ray's overriding enthusiasm has been in biology and medicine and in the problems of public acceptance of the AEC. For several years she conducted a television program in Seattle and is an accomplished public speaker.

## Just Jogging Along

by Ken Moore

With a "whoop" and a "holler" an enthusiastic group of SLAC joggers kicked off the first Group Run of the New Year.

Senior runner, Charlie Hoard, led the pack and set a brisk pace for the 4-mile circuit.

As this was not an official race, the joggers ran together for the first mile, and then each picked a pace he could comfortably handle to finish the course.

Those participating in the event were: John Alcorn, Lin Berg, Don Burwell, Dick Eary, Justino Escalera, Alex Gallegos, Charlie Hoard, Ken Moore, Gerard Putallaz, Ted Syrett and Bill Volpe. The Group welcomes other SLAC employees to join them.

The next scheduled Group Run will be held Friday May 25th at 12 noon.

Jogging is a great way to lose weight and keep in shape, and one of the side benefits of jogging around the accelerator is a chance to enjoy the pleasant surroundings, with the wildlife and shrubbery that pass by unnoticed when you're in an automobile.

To prepare for these events it is advisable to see your doctor first and get a checkup. Then start a program of jogging on a daily basis. 20 minutes a day is all the time you need to set aside for a two-mile jog.

There are people jogging at 12 noon and 4 p. m. daily around the accelerator if you need any advice or support.

## Answers to "GEORGE" Puzzle

1. George -- Ivory house, ale, cherry, Bay-Boy
2. Frenchman -- Blue, cider, succotash, cat
3. Englishman -- Red, rum, ham, Four-Flusher
4. Dutchman -- Yellow, gin, hot dogs, Polly
5. Scotsman -- Green, stout, beef, horse

Below are listed the "bare-bones" answers to Perry Wilson's George Washington's puzzle which appeared in the last issue of the BEAM LINE.

The following positions are available at SLAC for internal placement. The majority of these positions are vacancies created by the recent notification of lay-off to trial period employees. Both the present incumbents and other persons on lay-off notice may apply and will be afforded a preference for selection over other equally qualified applicants from within SLAC.

**Secretary I.** Perform secretarial duties for an experimental research group including typing manuscripts and lecture notes containing equations from handwritten copy. Maintain office procedures such as processing time records and purchase requisitions. Schedule appointments, meetings, and make travel arrangements. Requires good typing skills and some technical typing experience. No. 8022, Salary \$460-\$588.

**Office Assistant II.** Purchasing Department needs a fast accurate typist with experience in office work to assist in posting of stores issues, receipts, and other transactions. Familiarity with posting machines and inventory cards helpful. Salary \$460-\$588, No. 7870.

**Secretary II.** Two positions available for a person to perform secretarial duties to a Department Head and supporting technical personnel. Duties will include typing correspondence and technical documents, taking dictation, and other secretarial and office support activities. Salary \$544-\$696, Nos. 6530 and 7260.

**Secretary II Specialist.** Variety of secretarial duties including taking dictation, transcription, and shorthand. Typing of manuscripts for publication requiring technical typing experience and knowledge of mathematical symbols. No. 8023, Salary \$572-\$730.

**Office Assistant III.** The Purchasing Department needs a person with typing proficiency and general office skills to coordinate and direct information between supplier and requestor. No. 7868, Salary \$544-\$696.

**PS&E Technician II (Electronics).** Two positions available. One for assembly work (No. 6659) and the other in shift operation and maintenance of power supplies (No. 6116). These positions require electronics training and experience. Salary \$730-\$932.

**Storekeeper I.** Two positions available to provide assistance in receiving, storage, and issuing activities for the SLAC stores facility which issues a wide variety of supplies and equipment. Requires knowledge of stores procedures, and a valid driver's license to operate forklifts. Nos. 7869-7871, Salary \$544-\$696.

**Auto & Equipment Mechanic, Leadman.** Service, repair and maintain a large motor pool. Requires skilled auto mechanic with many years of applicable experience. Supervisory experience desirable. No. 8016, Salary \$906-\$1000.

**Electronics Engineer.** Design solid state high and low speed analog and digital circuits and systems. Requires a thoroughly experienced BSEE or MSEE and current knowledge of design techniques, data acquisition systems, and computers. No. 5537, Salary open.

In addition to the above positions available at SLAC, a complete listing of open positions on the Stanford campus and the Stanford Hospital are posted outside of the Employee Relations Office, Room 238, A&E Building.

Contact the Employee Relations Office (phone extension 2355) if you are interested in any of these positions.

## "Shadows of Bliss" to be Shown

Do you ever wonder just what connection physics has with the everyday life that most of us know? This film is an entertaining yet serious approach to bridging the abyss between physics research and the general public's awareness of what lies behind it all.

The route to a comprehensive grasp of physics requires a deep mathematical background. However, through this film's imaginative and thoughtful approach for the layman, an appreciation for physics efforts can be developed. Atoms are shown as concert halls, pions as small boys, protons as motor cars, interactions as dances, and quarks as a series of moves in chess.

Produced at CERN in co-production with the British Broadcasting Corporation, the film will be shown on Tuesday March 13 at 12:05 p. m. in the SLAC Auditorium. Further announcement of the film will be made.

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