Rapid Cycling Bubble Chamber TURNS ON

RC-83, a search for "exotic" mesons, marks the beginning of physics research using SLAC's new 15-inch-diameter rapid-cycling bubble chamber (the "RCBC"). Although the RCBC operated reasonably well at 20 pulses per second during the January cycle for two million pulses, the March cycle will be the first devoted to physics using the new device and the chamber is expected to operate at repetition rates up to 30 per second, making the RCBC the world's fastest bubble chamber.

The chamber was designed specifically with "hybrid" bubble chamber/spark chamber experiments in mind. It differs slightly be able to expand to three per second. The chamber is a disc 15 inches in diameter and 5.5 inches high with a vertical axis. The camera system is located below the chamber itself; the lower face is a glass window to accommodate a three-lens single-track 35mm camera system.

The chamber has what might be called an electromagnetic drive system -- the expansion system, are a kind of loudspeaker, consist of a steady magnetic field which causes the chamber to expand when a pulse of electric current is sent through an armature coil. A second magnetic field, used for helping identify particle tracks, is produced by a 15 kilogram superconducting magnet built into the chamber's "noseman can." Other bubble chambers had bulkier magnets which made it difficult to get detectors near the chamber itself, says B. Lenz's group built and tested the magnet, which has operated very reliably.

The experiment, BC-82, will attempt to find "exotic" mesons, defined as those which cannot be made up of simple quark-antiquark pairs. Positive pi mesons at 8.5 GeV will be sent into the chamber and those collisions resulting in a proton being ejected in the forward direction will trigger the cameras. The experimenters will then look for newly-discovered mesons. No such mesons have been seen as of date.

They would automatically be "exotic" since quarks can only have one-third or two-thirds of an electron's charge and so combination of two such charges can add up to a net charge of zero (try it!).

The track idea, formulated in 1964 by M. Gell-Mann and G. Zweig, envision the observed strongly-interacting particles as being made up of three "superfundamental" particles, the quarks, along with their antiparticles. Mesons (strongly-interacting particles with half-integral values of spin) are made up of two quarks, while baryons (strongly-interacting particles with half-integral values of spin) are made of three quarks, at least in the simplest version of the model.

The experiment is "hybrid" in that the forward neutron, itself unobservable because it lacks charge, will be converted into charged particles in a downstream optical spark chamber and the RCBC will continue to record the tracks for the experiment's data analysis. If they do, the particle itself was not photographed in the chamber because of its extremely short lifetime.

And so the rho prime meson was born.

The group wants to obtain about 100,000 pictures. About 10 pi mesons per pulse will be sent into the chamber. Some one trigger is expected per 2000 tracks, one picture should be obtained per 200 pulses. Thus, were the chamber not triggerable, 50 million pictures would have to be analyzed, rather than the 100,000 which are desired.

The experimenters hope to see a few dozen "exotic" mesons after analyzing the data. If they do, it is an uneventful end to any underestimation of excitement will be generated within the physics community.

The experiment is a Purdue-Indiana University-SLAC-Vanderbilt collaboration. Our thanks to Arthur "Buck" Rogers, Group BC) for an interesting discussion on the chamber and on the experiment.

Principal SLAC people involved with the design and construction of the RCBC are Bob West (Bubble Chamber Operation head), Frank Forrester (Mechanical Engineering) and Rogers, Arthur "Buck" Rogers, a principal experimenter on the Rapid Cycling Bubble Chamber's first experiment, is shown at the 15-inch diameter, 40.5-inch high "sensitive" region of the chamber prior to reassembly for the experiment.

New Computers/Speedier Physics

It is belting that SLAC, in causing electrons to accelerate to nearly the speed of light, should also generate a continuing need for faster computer processing of information. As physicists progress toward experiments which outdate the equipment they use, the machinery they use, the machinery upon which physics knowledge is able to be analyzed must also change to accommodate the thought flow.

SLAC's recent purchase of two IBM 370/168 computer systems will permit work at SLAC to approach the capacity for which the accelerator was designed -- high speed experimental physics.

The Rho Prime Saga

In the beginning, that is September 1969, Bob Stock's Group 2 put out SLAC Publication 668 dealing with the results of a photoproduction experiment done in the two-meter streamer chamber. After looking at 463 events in which a photon-proton collision in the chamber yielded four pi mesons and a proton, the group discovered evidence for an "excitation" in the cross section of about 1.5 GeV and an extremely short lifetime.

And so the rho prime meson was born.

The particle itself was not photographed in the chamber because of its extremely short lifetime. It lived only about the time it would take a photon of light to travel a distance equal to the proton diameter. Other physicists in this experiment were A. Odian, J. Park, M. Swanson, W. F. Swanson, P. Villas, B. Young, D. Davier, F. Darabi, F. Price, and F. Litt. The rho prime experiment was conducted in a downstream optical spark chamber and its auxiliary support system.

A more recent experiment involving a different SLAC group and a University of California group, also "new" the rho prime and helped identify it as belonging to a class of short lived particles called "vector mesons" related to the photon and thought to help explain the way photons interact with nuclear particles.
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In the last issues of the Beam Line, we reported on the progress of the Personnel Department's Placement Assistance Task Force in registering SLAC people on layoff notice, in prepping resumes for interviewing, and interviewing. According to Personnel Director, Doug Dopen, all this activity has yielded some outstanding results. Of the 72 employees given layoff notices last month, 12 have been offered new positions. Another 10 have taken other ones in the Personnel office staff and will be available to anyone interested.

The 6-member Task Force of people from SLAC and the campus continues to meet weekly to formally and informally discuss more work. Their work will continue until all offficials have been successfully placed.

SLAC Job Opening

The following jobs available at Stanford are just a few of many jobs available on campus. For more information, contact SLAC Employee Relations, extension 6255.

PSR Technician III, Shift work. Operate and maintain four-channel TV network. Requires second class FCC license for battery. No, 1796, Salary $944-$1078.

PSR Technician IV. Construction of various hardware boxes including equipment associated with high power transmitters. No, 1796. Salary $944-$1076.

Facilities Engineer III, Technical assistance to students pursuing advanced degrees in Mechanical Engineering, No. 17126. Salary $500-$600.

University Job Openings

The project team needs technical infrastructure people in the Materials Science area.

For more information, contact SLAC Employee Relations, extension 6255.

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