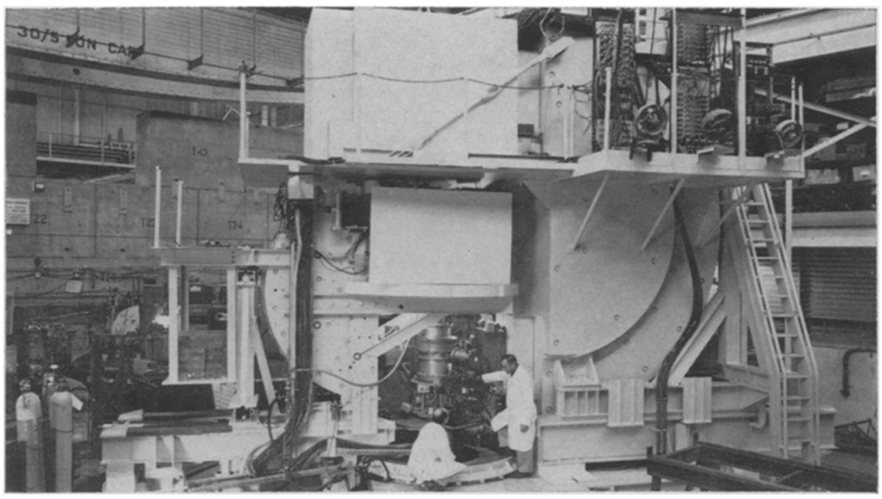


Stanford Univ.

The Stanford Linear Accelerator has never had the money to run at capacity.

Princeton Univ.

White: Trying to meet commitments.

PUBLIC POLICY

High-energy physics suffers a setback

Lack of Federal funds is forcing many accelerators to cut back or close down

by Dietrick E. Thomsen

Harvard Univ.

Strauch: Fighting a fact of life.

An accelerator laboratory for elementary particle physics has a number of resemblances to a small factory: in physical size, in capital investment (tens to hundreds of million dollars), in numbers of personnel and in operating economy. The owner of a factory is happiest when the market for his goods is such that he can run his shop 24 hours a day.

Similarly, particle accelerators are designed to run 24 hours a day the year around. Both economical operation of the equipment and swift completion of experiments that typically require hundreds of hours of running time recommend such a procedure. A certain amount of off time is necessary for maintenance and alteration, but the usual design goal is to run the machines between 90 and 100 percent of the time.

In the last few years most of the accelerators in the United States have worked considerably short of that operational goal, not for lack of demand —the market for their services is as bullish as the stock market was early in 1929—but for lack of operating funds. Unlike factories, accelerators do not adjust their operation to the market—the demand for time by scientists with experiments to run—they adjust it to the operating funds their patron chooses to supply them with. In the last few years that patron, the Federal Government, has grown increasingly stingy, and many experiments have gone undone. This year the stinginess has reached crisis proportions, and accelerators are beginning to die.

Physicists in and out of Government say that the White House and the Bureau of the Budget have imposed a ceiling on the Atomic Energy Commission's high-energy physics budget, out of which the accelerators are supported (SN: 3/7, p. 239). The result of a ceiling combined with rising costs is expected to be a gradual attrition of accelerators.

This year the 3-billion-electron-volt (GeV) Princeton-Pennsylvania Accelerator at Princeton, N.J., has been told to wind up its affairs, and the program of the 6-GeV Cambridge Electron Accelerator at Cambridge, Mass., has been cut in half. Future candidates for the ax are said to include the 6-GeV Bevatron at the Lawrence Radiation Laboratory at Berkeley, the 10-GeV electron synchrotron at Cornell University and the 12-GeV Zero Gradient Synchrotron at Argonne National Laboratory.

Candidates for survival are the National Accelerator Laboratory, which is now constructing the 200-400-GeV machine at Batavia, Ill., the 21-GeV Stanford Linear Accelerator (SLAC) at Stanford University and possibly the 33-GeV Alternating Gradient Synchrotron at Brookhaven National Laboratory.

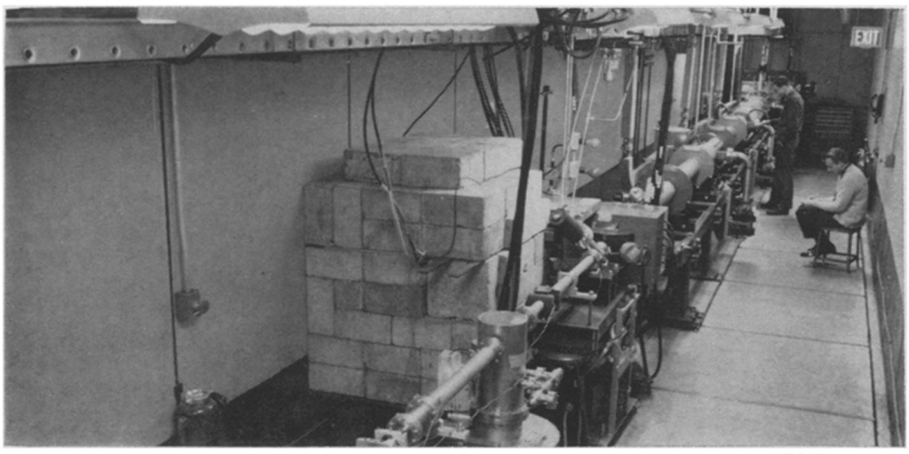
The cutback is not due to lack of business. When its death warrant was written, the Princeton-Pennsylvania Accelerator had an 18-month waiting list of approved experiments. Waits of a year are reported by SLAC and by Argonne.

In spite of this demand, the survivors are surviving just barely. If the AEC's fiscal 1971 budget proposal (SN: 2/7, p. 148) is approved, SLAC will get an increase of operating funds of about $600,000, but this will not compensate for inflation, according to Dr. Joseph Ballam, associate director.

At present, says Dr. Ballam, SLAC is

AEC

The PPA, with an 18-month waiting list, was told to wind up its affairs.



CEA/R. J. Levy

The Cambridge Electron Accelerator's activities will be halved by a budget cut.

running 55 to 60 percent of the time. If it had the money it could run 90 percent of the time. A further limitation imposed by low operating funds is the number of experiments that can be set up simultaneously. If there were funds to run the accelerator's bubble chambers continuously, says Dr. Ballam, they could take 15 million pictures a year.

The budget limits them to 4 million. In one year, the accelerator completed 9 bubble-chamber experiments and 11 that did not use bubble chambers. For $5 million more in operating money the number of bubble-chamber experiments could be about doubled and the others increased to 16 or so.

The accelerator's basic operating budget is about $25 million a year; Dr. Ballam divides the extra $5 million into $1.2 million for bubble chambers and $3.8 million for running time that would bring it up to capacity. If that were done it would be for the first time. Budget problems were already present when SLAC was completed; it has never been able to do all it can.

At Argonne National Laboratory the story is similar. "We have a very big backlog of experiments," says Dr. Bruce Cork, associate laboratory director for high-energy physics. He would like to run the Zero Gradient Synchrotron 24 hours a day all the year, but this year he figures the budget will force the accelerator to shut down for the month of May and possibly June.

At the moment, the Zero Gradient Synchrotron can operate at best two of its three bubble chambers, says Dr. Cork, and most of the time only one can be used. This means that the machine can carry about eight experiments simultaneously, although it could take twice as many.

The Princeton-Pennsylvania Accelerator is running about 15 eight-hour shifts a week, though it could do 21, says its director, Dr. Milton G. White. With the money left to him, he hopes to fulfill his commitments to the people whose experiments have been accepted. Meanwhile he is looking for alternate sources of money. One million or two million dollars will keep the PPA running at a reduced rate, says Dr. White, until conditions for high-energy physics improve. But he adds: "Lord knows when they're going to improve."

Other sources of money may be difficult to find. As Dr. Karl Strauch, director of the Cambridge Electron Accelerator puts it: "A fact of life is that high-energy physics involves money of an order that only the Government has."

The budget for the Cambridge Electron Accelerator will be cut by 30 percent if the AEC's proposals are accepted by Congress. Dr. Strauch says this will mean about a 50 percent cut in the CEA's activities.

The accelerator has been trying to do two things in parallel, he says. One is to perform experiments with the conventional sort of electron beam. Another is the development of colliding beams (SN: 7/13/68, p. 42).

Colliding beams are expected to open an entirely new level of detail in physicist's knowledge of elementary particles. The Cambridge Accelerator's is the only colliding-beam project now under way in the United States although the AEC hopes by juggling funds to make a start on a small one at SLAC. Several colliding-beam projects are being actively pursued in Europe and the U.S.S.R.

At Cambridge, a bypass that allows beams of electrons and positrons to be stored in the accelerator's ring so that they may be collided has recently been completed, and beams of both positrons and electrons successfully held in it for a sufficient amount of time. The next steps are to store the two kinds of particles simultaneously, collide them and increase the beam intensities to experimentally appropriate levels.

For the present, says Dr. Strauch, only the colliding-beam work will continue. Later, if the colliding beams are successful, the laboratory may try to go back to conventional single-beam experiments for those who want them, but Dr. Strauch worries that such resumption will become less and less likely since he fears the relevant staff will melt away.

Two groups which would have gone to the Cambridge Electron Accelerator are already inquiring at Stanford, "And that's just the first reaction," says Dr. Ballam. Argonne is getting inquiries from prospective PPA customers.

Ultimately, says Dr. Cork, it means a higher rejection rate. Argonne already rejects 50 percent of the proposals put to it, and even those that are accepted include experimenters who are persuaded to join forces.

The result will be fewer experiments and slower progress in particle physics. Dr. White worries especially about younger physicists, many of whom used to come to him for time on his machine. He fears they will lose out in competition for time at larger laboratories. "Only big farmers are going to be able to farm," he says. □