Research Trends: Others Suffer for the Good of the Fermi Lab

While the Fermi National Accelerator Laboratory has expanded operations since becoming the world's newest and most powerful accelerator facility, other U.S. accelerators have had their operations restricted or terminated during the depression in basic research activity of the last 5 years. The Atomic Energy Commission (AEC) is now running a research establishment with three accelerators besides the Fermi lab (FNAL). One major accelerator is supported by the National Science Foundation, at Cornell University. Only a few years ago the number of AEC accelerators was seven. Of the four remaining, three are now operating only about 50 percent of the time.

Support for the three older AEC labs at Brookhaven and Argonne National Laboratories, and the Stanford Linear Accelerator Center (SLAC), is already so restricted that further reductions will have disproportionately large effects. A 3 percent reduction in operating funds for high energy physics in fiscal 1974 is estimated to have cut research time at least 10 percent. The budget for fiscal 1975 is still uncertain, but it seems likely to be resolved in conference between the House and the Senate at a level that will reduce the operating budgets of the three older accelerators by at least $2 million each after inflation. Aware that such a budget would force all three laboratories below the previous low-water mark defined by half-time operation, two members of the AEC's high energy physics advisory panel (HEPAP) expressed the opinion last month that it would be a mistake to try to support a four-laboratory research program in the future with the current funding situation.

Federal expenditures for particle physics research do not seem to be correlated with intellectual progress in the field. Ironically, after almost a decade of unspectacular experiments, the last 18 months have brought three major findings that seem to be important signposts for new research directions. Scientists at CERN, the European laboratory in Geneva, announced in March 1973 that the likelihood for proton collisions keeps rising at higher energies. Seven months later, other experimenters at CERN found evidence from neutrino experiments for an important phenomenon known as neutral currents. Then in early 1974, it was found at Stanford that the best models for the structure of nuclear particles are grossly contradicted by the collisions of electrons and anti-electrons.

But the forecast for research in the coming year is gloomy. Because electrical power represents 10 to 15 percent of the cost of operating a large accelerator and the remaining costs are largely fixed, budget cuts can often be achieved only by turning the accelerator off part of the time. Ronald Rau, at Brookhaven, estimates that accelerator operation there will have to be reduced from 39 to 26 weeks per year if the House version of the fiscal 1975 budget is adopted. Besides the absolute limitations to research laid down by this, productivity is further limited because the time available for each experiment is less than optimum. A research team has less time to unravel the complexities of an experiment or to modify it, and so the risk of failure rises.

Accelerators Operating Half-Time

Groups of university physicists, whose support is separate from that for the accelerators, face tight funding too. Six groups of particle physicists funded by the National Science Foundation, at the universities of Colorado, Chicago, Houston, Michigan, and Indiana, have been forced to stop research completely in the last 3 years, and the university physicists supported by the AEC have been forced to cut out substantial parts of their programs—particularly bubble chamber studies. Many groups are now reduced to the point where there is only one person left for a particular function. One result of such pressure is that university researchers are spending more time planning and designing experimental facilities to be built by the accelerator laboratories—such as the multiparticle spectrometer at Brookhaven.

While the fiscal 1975 budget seems likely to reduce support for the three laboratories by $2 million, FNAL will probably not get more than $2 million in additional funds, after the high inflation rate for accelerator expenditures (estimated at 12.9 percent by SLAC) is taken into account. Historically, the funding for a new laboratory rises rapidly in the first few years to take advantage of its peak in scientific productivity, then levels off and eventually declines, in a pattern that follows its scientific lifetime. Administrators at FNAL requested $48 million for fiscal 1975, but will probably not receive more than $35 million. They think that the budget is rising much too slowly, and the funding pattern for SLAC, the last accelerator completed before FNAL, indicates they may have a point. Whereas the operating funds for both SLAC and FNAL doubled within 2 years after they were turned on, the initial funding for FNAL was the same as for its predecessor, even though the facility is twice as large.

Brookhaven and SLAC, in conjunction with Berkeley, have proposed two new accelerator facilities (*Science*, 31 May 1974), which are not only needed to do new physics but also would introduce new life into their experimental programs. A subpanel of HEPAP chaired by Victor Weisskopf has recommended the Stanford-Berkeley proposal, a storage ring for colliding beams of electrons and anti-electrons, be authorized in fiscal 1976. The subpanel also recommended that Brookhaven be given $3 to $4 million for further tests leading to construction of a superconducting accelerator for colliding beams of protons. But Argonne, already receiving the lowest support of the AEC labs, seems sure to be closed. The only question is how soon. Other subpanels found that any laboratory needs 2½ years notice to close efficiently, and recommended that the Argonne program be continued at least 4 more years. Argonne, which started its experimental program very slowly 10 years ago, was found to be producing its best research now.

The press of new construction funding now advised for next year, along with the need of FNAL to expand, seems likely to mean continuing turmoil for high energy physics. As Val Fitch, of Princeton, pointed out at the HEPAP meeting, a constant budget means that the number of scientists cannot increase. So the opening of new facilities will require the closing of older ones, even though they may still be capable of much productive work. Some experiments in some energy ranges will have to be left undone if physicists continue to give first priority to higher and higher energies.—WILLIAM D. METZ