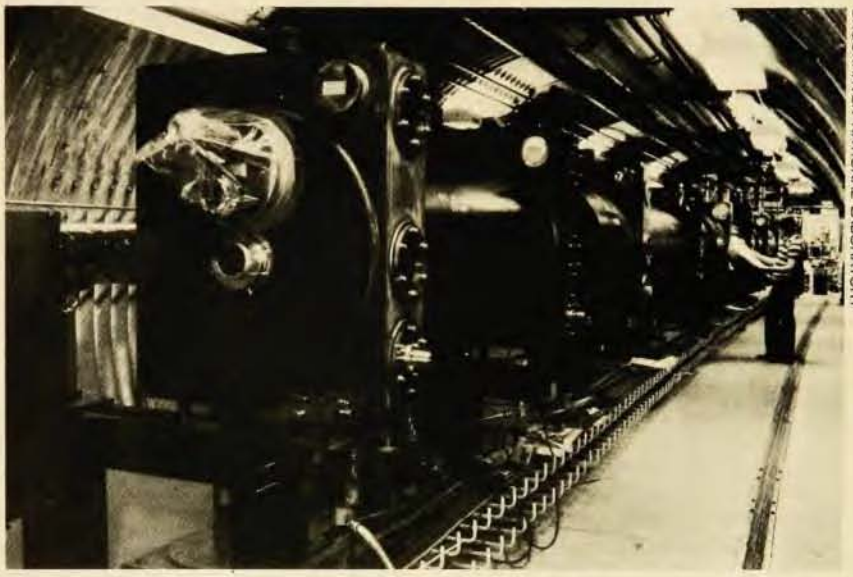
state & society

Scope of US particle-physics program may need reduction

The US high-energy physics program will have to rely increasingly on "special effort and ingenuity" to remain competitive with Western European research centers, according to the report of a subpanel of the Department of Energy's High Energy Physics Advisory Panel. The group was charged with reviewing the status and prospects of the program and developing a strategy for the program over the next decade, including specific recommendations for Fiscal Year 1982.

The HEPAP subpanel, headed by Sam Treiman (Princeton University), was the fourth in a series of so-called Woods Hole subpanels (PHYSICS TODAY, November 1977, page 93). It was given a more general charge than the previous subpanels, which were concerned chiefly with new research facilities.

Reviewing the progress made in our understanding of the subnuclear world in the last decade, the subpanel praised the work that led to successful theories for strong and weak interactions. "The field in 1980 has progressed much further than anyone could have dared to anticipate in 1970... If the present theoretical optimism is confirmed by the experimental program of the 1980's, we will have largely accomplished an advance in our understanding of the basic forces of nature comparable to the establishment of the theories of electrodynamics and gravitation."



BROOKHAVEN NATIONAL LABORATORY

Mock-up of a section of the Isabelle tunnel, showing a string of superconducting magnets. Problems with the development of superconducting magnets for both Isabelle and the Energy Saver need to be solved, according to a report to the High Energy Physics Advisory Panel.

Funding levels. The current level of funding for the particle-physics program is nominally governed by the DOE/Office of Management and Budget Long-Range Plan of 1978. That plan set a floor for DOE funding of high-energy physics at $300 million in FY 1979 dollars. But the "painful reality," as Sidney Drell, HEPAP chairman, put it, is that inflation in power and other technological costs has not been fully allowed for in the conversion from 300 million 1979 dollars to real dollar budgets, so that a deficit has developed with respect to the DOE/OMB plan. According to Drell, this has "severely limited the R&D program underpinning the ongoing construction, and has also reduced the level of utilization of existing facilities to the point of causing a serious loss of physics as well as great inefficiencies and difficulties for the research groups." HEPAP estimates that the high-energy physics program has fallen about $45 million short of the DOE/OMB plan since FY 1979. According to Drell, "Continuation of the current funding restrictions may force reduction in the scope of the US high-energy program."

In addition to the financial difficulties, the subpanel noted that the new superconducting magnet technology involved in the Isabelle and Energy Saver projects at Brookhaven and Fermilab, respectively, is turning out to be more arduous than had been anticipated. The subpanel noted that the two labs have different problems to overcome and that Fermilab is closer to a resolution than Brookhaven. The group suggested that Isabelle might benefit from an infusion of technical expertise both from within Brookhaven and from the physics community at large.

Aside from their technical challenge, the superconducting-magnet problems also reduce the money available to the rest of the program. For example, because Fermilab has had to focus on the Energy Saver construction project, the existing 400-GeV accelerator there is at present being used less than 50% of the available time. DOE considers a utilization level of about 75% optimum. According to William Wallenmeyer, director of the DOE high-energy physics division, Fermilab is not the only laboratory beginning to dip below 50% use time, and the prospects for FY 1981 look even bleaker.

Among the victims of such underutilization are university-based research groups, which have suffered as well from lack of adequate equipment funds, serious increases in necessary travel costs, erosion of their efforts by inflation and increased overhead charges. The Woods Hole group therefore recommended greater use of the forefront accelerator facilities—the Fermilab 400-GeV accelerator, the newly commissioned PEP storage ring at SLAC and the CESR facility at Cornell.

The subpanel discussed in detail the problem the US is having keeping pace with high-energy physics advances

0031-9228 / 80 / 08121-04 / $00.50

abroad, particularly in Western Europe. The level of financial support in Western Europe now substantially exceeds that in the US, and it is therefore necessary, according to the subpanel, "for the US to rely increasingly on special effort and ingenuity to keep our program at least well represented at the major forefronts." It is no longer financially possible for the US to proceed in parallel by the scaling up of conventional technology, concluded the subpanel, but the US can engage in more "financially modest" projects based on inventive new technology.

New facilities. In the tradition of past Woods Hole subpanels, the HEPAP group reviewed several ideas for new facilities, including the Stanford Linear Collider proposal for an e^+e^- collider at 100 GeV center-of-mass with one interaction region (PHYSICS TODAY, January 1980, page 18); an e^+e^- ring contemplated by Cornell at 100 GeV center-of-mass, with four interaction regions; and a possible electron–proton facility involving a 10-GeV electron ring used in conjunction with a high-energy proton beam at Fermilab or Brookhaven, being explored by a Canadian consortium and independently by a US group at Columbia University. They concluded, however, that it would be "premature to make a decision now on the exact direction such efforts should take. Maturing initiatives can be considered within the next one or two years." One of the report's recommendations is that a similar group convene in one year and reexamine these proposals.

The subpanel also considered opportunities for the more distant future, when still higher energies will clearly be important, such as Fermilab's Pentavac (a 5-TeV proton accelerator), and SLAC's idea for two large linacs that would give 350-GeV electrons and positrons colliding head on.

The subpanel made the following recommendations for the next funding cycle:

- The Fermilab 400-GeV accelerator, the newly commissioned PEP storage ring, and the CESR facility at Cornell must be used as fully as possible to exploit for physics the large investments already made.
- Construction of the Energy Saver and of Isabelle must proceed with all deliberate speed. Necessary R&D funds must be provided to ensure their success.
- University-based groups should receive increased support to assure vitality of their efforts on immediate experimentation and also on detector development for the future.
- Accelerator studies and technical research should begin immediately toward the goal of starting the construction of a very large accelerator (electron energies of several hundred GeV or proton energies of 10 TeV or more) during the second half of this decade.

With regard to budgets, the subpanel stated that if the funding level remains at or below the 1978 DOE/OMB guidance level, the programs at the lower-energy facilities, such as the Brookhaven AGS and SLAC linac, will have to be reduced and new construction initiatives will have to be foregone. Even the DOE/OMB plan level of $300 million may be too low to buy the amount of research DOE and OMB had in mind when they constructed the plan, according the Wallenmeyer. DOE and OMB underestimated what the desired level of effort would cost, and we have fallen somewhat short of even that underestimate because of the inability to adequately estimate recent inflation rates, he said.

If, however, the program is given a modest (15%) increase in support beginning in 1982, it would be possible to begin a new construction initiative. "Specifically, the future US program would be greatly strengthened by an electron–positron collider operating in the energy region between about 30 GeV and 100 GeV, where a rich output of physics is anticipated. Similarly, a facility designed to study high-energy electron–proton collisions promises exciting physics opportunities. It may be that both the above goals can be met with a combined facility."

Accelerator R&D. The subpanel report emphasized the importance of detector and accelerator R&D. Very high-charge-density bunches with low emittance in linear accelerators, very high-field superconducting magnets and superconducting rf cavities were singled out by the subpanel as being of great importance. "The present difficulties with superconducting magnet technology show that economies of effort and funds and more expeditious construction can be realized in the future if more extensive R&D occurs early in the technological innovations necessary for new facilities," the Woods Hole group said. But much of the R&D effort in the current US program is aimed at the short-term goals of existing or imminent projects. They warned that it is increasingly important to upgrade the effort devoted to goals of longer range.

Long-range R&D should be supported at a level approaching 4% of the operating budget, whatever that may be, they said, as was recently recommended by the HEPAP subpanel on accelerator R&D. This subpanel, headed by Maury Tigner (Cornell University), focused on questions connected with the long-term future of the field. It identified specific technical areas that need to be emphasized in long-range R&D. These include very high-field accelerator magnets, liquid-helium refrigerator systems, microwave linac gradients, beam–beam interactions and new accelerator schemes with high performance potential, such as laser accelerators.

The accelerator R&D subpanel also recommended that laboratory and university managements take specific measures to make participation in accelerator R&D practical and more desirable for high-energy physicists and facilitate cross-fertilization from other fields such as plasma physics, lasers and materials science. —MEJ

Kislik committed to mental hospital

The struggle to protect dissident and refusenik Soviet scientists was dealt two severe blows in recent months, with the two-week commitment of Soviet nuclear physicist Vladimir Kislik to a mental institution and the attack on a French physicist, Paul Kessler, in the Soviet city of Kiev while he was visiting Kislik and other refuseniks.

After participating in the Fourth International Conference on Collective Phenomena in Moscow last April, Kessler, a physicist at the College de France, went to Kiev to collect information on the refuseniks in that city, which he learned number about 12 000. While in Kiev, Kessler visited Kislik, who has been refused an exit visa since 1974. In the past few years, Kislik has been given false hopes of emigration by various Soviet authorities (his former wife and son now live in Tel Aviv, Israel). Kessler found him living in destitution with his father, holding only temporary clerical jobs. His mail and scientific materials have been confiscated.

"I was able to notice, very quickly," Kessler said, "that the KGB was watching me and was not going to make things easy for me, as far as I intended to pursue my mission in Kiev." The evening after his visit with Kislik, Kessler was repeatedly awakened in his hotel room by people knocking on the door and "entering the room on various pretexts." The next day, as Kessler was entering the house of another refusenik family, he "was stopped downstairs by four men, beaten up and expelled from the house," as Kessler related the incident. He believes the men were KGB agents. "I was afraid they would not let me leave Russia easily," said Kessler, but he left Kiev the next day without incident.

"To my knowledge, this is the first

continued on page 124