Panel: Finish Isabelle if particle physics gets enough funds

The HEPAP subpanel headed by George Trilling of Berkeley has strongly recommended that the Isabelle project at Brookhaven be completed during this decade. However, the subpanel noted that "Isabelle construction and the other essential components of the US program require a minimum annual level of support that averages $440 million (FY 1982 dollars) in DOE funds per year. If support at this level cannot be made available in time for Isabelle completion within this decade, the Isabelle project cannot be continued."

At a meeting in Washington on Sunday, 1 November, the High-Energy Physics Advisory Panel, headed by Sidney Drell (SLAC), unanimously endorsed the subpanel report. In Drell's transmittal letter to Alvin Trivelpiece, director of the DOE Office of Energy Research, he noted that the Trilling subpanel identified a minimum annual support level averaging $440 million (FY 1982 dollars) in DOE funds per year plus about $35 million of NSF support for the high-energy physics program. "HEPAP endorses this recommendation with the proviso that substantial progress toward the $440-million funding level (in FY 1982 dollars) be achieved in FY 1983 and that the Administration make a commitment to support the national program at the $440-million level in FY 1984 and beyond."

Earlier that day, some HEPAP members had met with Presidential Science Advisor George Keyworth, who advised them to present the strongest scientific arguments for the budgetary needs of the program in FY 1983. He said they could say anything they wanted to in their recommendations regarding FY 1984, because nobody knows what will happen with that budget. Although President Reagan's March budget request for FY 1982 had contained $393 million for DOE high-energy physics, the additional 12% cut imposed by the Administration in September reduced the FY 1982 budget request to $346 million.

When we met with Trivelpiece a few days after the HEPAP meeting, the Senate had not yet passed an appropriation bill for DOE. Meanwhile, he said, a DOE lab director such as Wolfgang Panofsky of SLAC has to decide on his own whether he should retain or fire staff. "If the 12% cut is real, his budget is insufficient for the rest of the fiscal year." By the time his budget is known, if he hasn't fired some staff the number to be terminated will be even higher. "Since we don't know what the budget will be, we can't give him guidance."

The 1981 HEPAP subpanel on long-range planning in high-energy physics was asked to develop a plan for the US program in the next decade at various funding levels (due 1 January) and an interim report on Isabelle (due 1 November). Chairman George Trilling noted in his oral report to HEPAP that the main theme of the 170 letters from the high-energy community was "extreme concern about the support level of the program and fear that Isabelle construction without adequate support for the total program will irreparably damage the program." Drell remarked that "the greatest risk is that we'll bleed the rest of the program to keep a small Isabelle program."

The HEPAP meeting had a large audience in attendance, and the atmosphere was tense. Throughout the day one noticed signs of small, private conferences among HEPAP members and other interested parties.

For some time Isabelle has been troubled with management and magnet difficulties (PHYSICS TODAY, April 1981, page 17). Over the past few months both kinds of problems have shown signs of being solved. Most noteworthy, in September Brookhaven dropped the use of single-layer braided conductor in the superconducting magnets and changed to the so-called Palmer magnet, which uses Fermilab-style Rutherford cable. Late in October a full-size (15-foot) Palmer magnet showed excellent maximum-field capability with essentially no training (see the figure on page 52).

The Trilling report says the essential components of the US program, "which must be supported whether or not Isabelle is constructed," are:

▶ Adequate utilization of existing facilities. "Important experiments are not performed or are prolonged unreasonably. More support for accelerator operations and the physicists that use these accelerators is required. Support for large non-accelerator particle-physics projects is becoming increasingly important."

▶ Expeditious completion of the Energy Saver at Fermilab and initiation of the Tevatron II (with 1000-GeV protons) fixed-target program, which opens a new energy region and gives broad opportunities for a diversified program.

▶ Completion of the Tevatron I anti-

15-foot Palmer magnet for Isabelle undergoes a check at Brookhaven before it is returned to a Dewar for cooling to 3.8 K.

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proton–proton collider, with 1000 GeV in each beam; it "represents an exciting step to a new energy frontier in hadron–hadron physics."

▶ R&D work at SLAC leading to the SLAC Linear Collider project (PHYSICS TODAY, October, page 17). "This effort is extremely important in developing techniques needed to reach super-high energy in electron–positron physics (e.g. 350 GeV × 350 GeV colliding electron linacs) for the long-range future. Moreover, SLC presents an attractive and inexpensive means for building an electron–positron project in the Z^0 energy region."

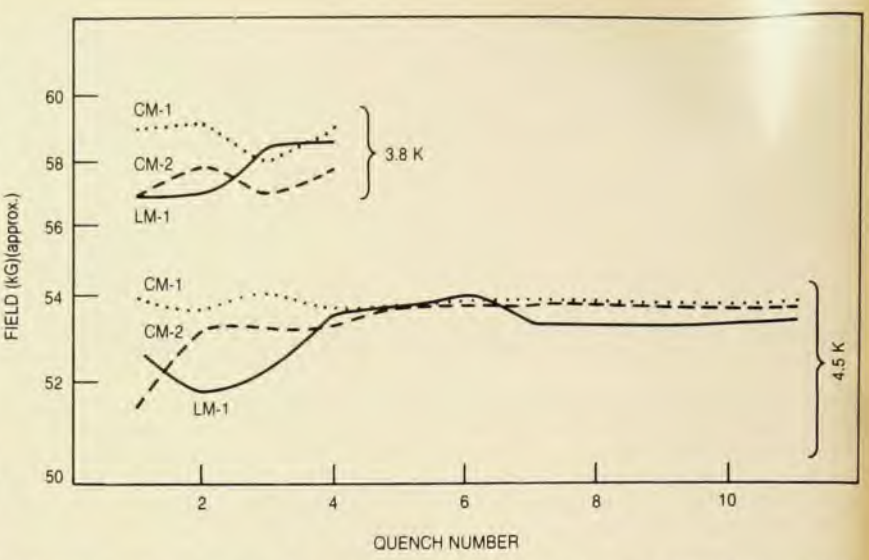
▶ Development work on superconducting cavities at Cornell (PHYSICS TODAY, August, page 20). "This work is of outstanding quality and opens the possibility of constructing a more cost-effective future electron–positron facility."

▶ Accelerator R&D on high-field superconducting magnets, high gradient accelerating structures, and novel methods of acceleration."

In his letter to Trivelpiece, Drell said there were two funding requirements for the construction of Isabelle: that funding must be sufficient for Isabelle completion within this decade and that "funding must be sufficient to support adequately six essential components of the national program, whether or not Isabelle is constructed .... If the two funding requirements cannot both be met, then the Isabelle project cannot be continued."

A companion letter by Drell to Keyworth, dated 4 November, says "HEPAP recognizes that high-energy physics, along with the rest of the nation, faces short-term budget stringencies that may very well disrupt long-range goals. In accord with our responsibilities we must point out however, that failure to maintain adequate funding in this short term will have serious, harmful impact on the future of the field." Drell went on to say that the "minimal program" (without Isabelle) identified by the Trilling committee would cost $395 million (FY 1982 dollars) from DOE and $35 million from NSF for high-energy physics .... Although it provides for the advanced accelerator R&D effort vital for future accelerators, there will be relatively limited opportunities for experimentation on the high-energy frontiers at the end of this decade. The loss of Isabelle would be a severe blow to the strength and diversity of the US program in elementary-particle physics in the late 1980's and the 1990's."

Isabelle status. At the HEPAP meeting, Trilling presented the case on behalf of Isabelle. In 1990, exclusive of Isabelle, the US program would have a maturing Fermilab fixed-target program, very mature lower-energy programs and PEP, important but limited forefront opportunities from the Tevatron I and SLAC Linear Collider. Isabelle would offer the major new center in the 1990's and has a high potential for new discoveries because: it has high energy (400 GeV in each beam) and high luminosity (about 10^{33} cm^{-2} sec^{-1}); it is a dedicated storage ring; it has six interaction regions, and it has growth potential (could be modified to be an electron–proton machine or to use heavy ions). By contrast, Tevatron I will have one fully developed interaction region and one partially developed interaction region and will have to share its time with the fixed-target program. Tevatron I will have a higher energy (1000 GeV in each beam) than Isabelle, but its luminosity is expected to be a factor of 1000 lower.



Training curve for the three Palmer magnets built at Brookhaven; they use Fermilab-style Rutherford cable. CM-1 and CM-2 are both five-foot magnets; LM-1 is full-size (15-foot). After several quenches at 4.5 K, all three magnets settled down to roughly the same magnetic field. At the Isabelle operating temperature of 3.8 K, LM-1 reached 5.8 T in a few quenches.

Trilling noted that Isabelle would be good for "studies of W and Z production dynamics, dilepton production, high transverse momentum jets to test quantum chromodynamics; search for the top quark; searches for additional weak gauge bosons or other new particles; surprises and new discoveries."

In the technical assessment portion of the Trilling report, the Isabelle management situation is discussed. Since June, when Nicholas Samios was appointed Brookhaven deputy director for high-energy physics, the report said, the Isabelle management structure has improved. "Several critical policy decisions relative to Isabelle have been taken (adoption of one of the new cable magnets, the 1984 goal for test of the first sextant, etc) and a reorganization is underway which should improve internal communications and more sharply delineate lines of authority and responsibility. There is a recognized need for the appointment of a Project Director and a search (difficult under the present circumstances) is underway to find a senior individual to take over the project ... morale of the key individuals of the project is reasonably high now that an attractive magnet option has been chosen. Overall morale has, of course, been eroded by the uncertainties associated with continuation of the project, particularly in the light of recent further budget cuts."

Discussing the magnet situation, the report says that the new design incorporating Fermilab-style Rutherford cable preloaded by bolted-up split iron yokes, "provides an excellent basis for a magnet development and construction program which should lead to a satisfactory set of magnets for Isabelle." At the Trilling report's writing, in mid-October, the first two short (5-foot) prototype magnets (CM-1, CM-2) "have demonstrated excellent maximum field capability, namely 5.85 tesla (at 3.7 K) with essentially no training, and indicate that the coil and yoke design provide the necessary mechanical properties for large-aperture high-field magnets." By late in November, the Isabelle magnet division, headed by Robert Palmer (who designed the new magnet variety), had operated the 15-foot magnet (called LM-1) at 4.5 K, and it reached 5.255 T on its first quench. At the Isabelle operating temperature of 3.8 K, the magnet reached 5.8 T by the fourth and fifth quenches. Similar behavior had already been shown in the five-foot magnets.

The plans for the magnet R&D program call for producing by next fall one

full-length dipole per week, according to Palmer. By April 1984 plans call for about 100 magnets to have been built with 54 dipoles and 23 quadrupoles assembled into a sextant ready for test with beam. By late 1984 the magnets would be cooled down and operated in the Isabelle pulsed mode to provide an integrated systems test. The report says that the R&D schedule is ambitious but with adequate financial resources and proper management the schedule can probably be met. Once the R&D program is completed, it "will provide an adequate test of magnet production capability and enable BNL to proceed with full-scale magnet production."

Concerning the rest of the accelerator systems, Trilling, in his oral report to HEPAP, said that the lattice design is sound and that the vacuum system design is advanced but that other systems are not so far along. He said the panel believes the initial luminosity goal of 2×10^{32} cm^{-2} sec^{-1} is realistic.

The remaining Isabelle cost for construction, R&D, pre-operations, equipment (including detectors) from FY 1983 onward would be about $500 million (FY 1982 dollars). To complete Isabelle by the end of the decade, Trilling said in his oral report, DOE would need a substantial funding increase for high-energy physics in FY 1983, and by FY 1984 one would need to reach $440 million to allow the continuation of Isabelle. —GBL

What will be the future role of national laboratories?

The role of national laboratories is being examined by a number of groups—the White House Office of Science and Technology Policy, the Department of Defense, the Department of Energy, and at least two energy subcommittees in the House.

OSTP plans to examine the role of all Federal intramural laboratories, including those run by DOE, NASA, NOAA and DOD, whether the lab is run by a contractor or not. University and private-sector labs will not be included in the study. According to Douglas Pewitt, now deputy director of OSTP, the Federal government in FY 1982 will spend $15–20 billion on 770 intramural labs. The OSTP review is scheduled to end next summer, but at this writing OSTP is still deciding who will conduct the review.

The Defense Department is already studying its labs, under the direction of Richard De Lauer, who is undersecretary of defense for research and engineering.

Meanwhile, as the Administration plans to disband DOE altogether, many are concerned about the future of DOE-supported research. When we recently visited Alvin Trivelpiece at the Office of Energy Research, he said that DOE functions are likely to continue—civilian nuclear work, weapons production and energy research, regardless of the reorganization.

One persistent rumor is that DOE plans to close one of its multiprogram labs; both Argonne and Brookhaven have been rumored to be in danger. Trivelpiece denied there is any plan to close any multipurpose DOE lab. However, he said, their roles and missions are going to be reviewed. "That doesn't mean we won't consider slowing down and relocating any of the projects at the multiprogram labs. We'd have to invent the national laboratories if we didn't already have them."

Trivelpiece said that hearings have been held under Congressman Don Fuqua (D.-Fla.) to review the missions of the national labs. On its own, through the Energy Research Advisory Board (now headed by Louis Roddis), DOE is reviewing its multiprogram labs and its weapons labs. Trivelpiece hopes the ERAB subpanel will do a long-range look at the labs, considering the appropriate roles for university, industrial and national labs. In addition, Trivelpiece's Office of Energy Research will do its own review of the national labs, involving management and technical issues. The output of both studies should be useful to Presidential Science Adviser George Keyworth.

Keyworth, in a recent speech celebrating the 50th anniversary of Lawrence Berkeley Laboratory, described the OSTP plan to look at the missions and functions of the national labs. He said, "We are examining ways to keep an adequate number of our best young scientists and engineers in advanced research and on our faculties. . . . I think that the national laboratories can play a role in meeting this objective. A wealth of talent exists in the labs to be used in a number of effective ways. The national labs can serve as new training grounds. You can work more closely with industry and academia to create new programs for manpower planning and supply."

"This Administration cannot continue in its budgeting exercise without taking an unprecedented look at the national laboratories and the nation's 'return on its investment,' as it were, from these institutions. . . we are beginning this initiative now. It is one I most certainly intend to carry out in concert with members of the entire scientific community. . ."

"If all this sounds somewhat foreboding to some of you, I'd like to interject an optimistic note here. The scientific community has historically—and particularly in recent years—had a tendency to overreact to the slightest government examination. And therefore, I would encourage you not to be looking for disaster around the corner. It won't come. . . ."

"We are convinced that the national laboratory system comprises a resource of enormous value, one whose health is of paramount importance." —GBL

NSF funds two math institutes

The National Science Board, after considering the recommendations of three NSF panels, recently approved five years of funding for two national institutes for research in mathematical sciences.

The University of Minnesota in Minneapolis was awarded $800 000 for the first year to establish an institute to bridge the gap between discoveries in pure mathematics and their application in other disciplines. The institute will be headed by Hans Weinberger as director and George R. Sell as associate director and will spend its first year considering statistical and continuum approaches to phase transitions.

The Mathematical Sciences Institute at the University of California, Berkeley will concentrate its first year of research on nonlinear differential equations, and numerical methods and statistics. A grant of $1.6 million for the first year will be used to establish the institute, projected to support up to 50 researchers in pure and applied mathematics. Each year the staff, led by Shing-Shen Chern as director and Calvin C. Moore as associate director, will select two areas of mathematics for study.

in brief

The National Research Council will administer about 35 postdoctoral fellowships for Native Americans, Alaskan Natives, blacks, Mexican-Americans and Puerto Ricans engaged in