HEPAP STUDY

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In early June the High Energy Physics Advisory Panel (HEPAP) carried out an in-depth study of the U.S. high energy physics program for the period 1985-1995. Prior to this study, HEPAP working groups met at Brookhaven National Laboratory, Fermilab, and the Stanford Linear Accelerator Center (SLAC) to gather information covering the areas of e^+e^- facilities, fixed-target facilities, hadron colliders, the Superconducting Super Collider, accelerator operations and advanced accelerator R&D, and non-accelerator physics and interfaces with other fields. As part of each of these informal meetings, a "town meeting" was held which provided an opportunity for an exchange of views between interested physicists and HEPAP members. Another gathering was held at the National Academy of Sciences in Washington, DC, with the directors (or their representatives) of CERN, DESY, KEK, and the U.S. high energy physics laboratories at which the future plans for each of the laboratories were presented and discussed.

The findings and conclusions resulting from this study were discussed and finalized at a HEPAP meeting in Germantown, Maryland, July 1-2, 1985. They were also presented at the meeting of the Division of Particles and Fields in Eugene, Oregon in August. The formal "Report of the 1985 High Energy Physics Advisory Panel Study of the U.S. High Energy Physics Program 1985-1995" is to be issued soon by the U.S. Department of Energy, Office of Energy Research, Division of High Energy Physics. The following is the Executive Summary taken from this report.

Executive Summary

Motivated by the need to gain a better understanding of the U.S. high energy physics program, including a reassessment of the goal of building the Superconducting Super Collider (SSC), the High Energy Physics Advisory Panel (HEPAP) has carried out an in-depth study of the U.S. High Energy Physics Program. The HEPAP Study, which covered all aspects of the U.S. program, was held June 2-8, 1985, at the Coolfont Conference Center in Berkeley Springs, West Virginia. In preparation for the Study, a major information -gathering activity was carried out during the spring of 1985.

The Panel has concluded that the physics justification for a multi-TeV, high-luminosity hadron-hadron collider is even stronger today than it was in 1983 at the time of the original HEPAP recommendation. Furthermore, the technical successes achieved in the SSC

research and development program reinforce the confidence that this facility can be built within the costs and on the time scale estimated in the Reference Designs Study.

The Panel has evaluated the physics opportunities in the program for the period of approximately 10 years before the SSC would come into operation. These opportunities provide for a rich physics program with excellent prospects for fundamental discoveries. The superconducting Tevatron at the Fermi National Accelerator Laboratory (Fermilab) is operating at an energy of 800 GeV and provides the highest energy fixed-target facility in the world. The Fermilab Collider will become operational in 1987 and will be the world's highest energy hadron collider, extending the energy range to 1.8 TeV from 0.6 TeV available now at the CERN $S\bar{p}pS$. The Stanford Linear Collider (SLC), which will come into operation in 1987 at the Stanford Linear Accelerator Center (SLAC), will be the first e^+e^- collider to reach the energy of the Z^0 and also represents a pioneering effort toward a new class of electron-positron colliders. The effective utilization of these new facilities is an essential requirement.

The physics opportunities also include major U.S. participation in research programs at new facilities abroad: at CERN, the Large Electron Positron (LEP) project will become operational in 1989, providing e^+e^- collisions initially in the Z^0 range and later at higher energies, up to 200 GeV in the center-of-mass; in Japan, the TRISTAN project will become operational in 1987, providing e^+e^- collisions up to a center-of-mass energy of about 60 GeV. In West Germany, the Hadron Elektron Ring Anlage (HERA) project, which is expected to begin operations in 1990, will provide $e^{\pm}p$ collisions up to center-of-mass energies above 300 GeV, opening new opportunities for research.

The Panel has identified a limited number of programs which, because of their intrinsic importance, their likely impact on the course of future research, and their key role in the U.S. program, should proceed with priority. The Panel places the following major programs in this category: The Collider Detector Facility (CDF) and DO projects at TeV I, the L3 program at LEP, the Mark II and Stanford Linear Detector (SLD) projects at the SLC, and the CESR program at Cornell. The Panel also considers the smaller scale efforts involving studies of CP violation with kaons, high sensitivity studies of rare kaon decays, and certain parts of the non-accelerator program to be in this category.

It is clear that a project of the magnitude of the SSC will require major redirection of high energy physics resources during the next 10 years. However, this Study shows that it will be possible to achieve a reasonable transition into the SSC program. Some of the existing programs will be terminating just as extensive effort on SSC detectors will need to commence. The timely completion of the SSC will provide a truly forefront facility for the world's high energy physics community. The Panel notes, however, the inevitable deterioration of the U.S. program and the difficulty of maintaining continuity of the field if the SSC were delayed appreciably beyond the presently-anticipated time scale. If this were the case, there would be no frontier facility in high energy physics in the U.S. in the mid-1990's.

Finally, the Panel notes the importance of maintaining and strengthening the technology research in advanced accelerator R&D. This research is essential to the long term progress of the field.

On the basis of this Study, HEPAP makes the following recommendations:

1. We recommend that the SSC R&D be given highest priority in the U.S. High Energy Physics Program so that the project can proceed to an early construction start and rapid completion. In particular, for FY 1986, we support the requested incremental allocation of $7 million to SSC R&D, primarily so that early substantial industrial involvement in the magnet R&D effort can be initiated.

2. We recommend that the limited category of forefront programs identified in the report proceed with priority.

3. We recommend that the overall funding be adequate to permit the effective implementation of the broadly-based program providing essential diversity and scope with high priority to the special programs and to pursue the crucial SSC R&D effort.

   Comment: For FY 1987 this would require a small increase beyond the FY 1985 total level of effort. With reduced construction activity, this would allow the increased funding required for the utilization of the new capabilities coming into operation (the SLC at SLAC and the Tevatron at Fermilab) and for the SSC R&D effort.

It is clear that construction of SSC and fabrication of detectors for SSC will require incremental funding above this level. A funding profile such as shown in Section IV would ensure the scientific vitality and stature of U.S. high energy physics during the period prior to SSC operation. After the SSC is completed, it appears that an excellent program, including the SSC and a reduced non-SSC program, could be supported at a funding level about 10 percent above the current (FY 1985) level of effort.

4. We recommend that advanced accelerator R&D be strongly supported. A continued and strengthened effort in this area is essential to the long term progress of the field.