

Physics Advisory Committee Meeting

June 13-19, 1987

General Remarks and Recommendations

Fermilab recently completed a very successful first physics run of the $\bar{p}p$ collider at 1.8 TeV. During the course of that run the Accelerator Division increased the $\bar{p}p$ luminosity to levels competitive with the CERN S $\bar{p}p$ S. In particular the initial physics output from the CDF detector looks most promising. A long fixed-target run with emphasis on stable running is now in progress. The Committee endorses the Laboratory's plan for maximum utilization of its facilities within available resources. Cycles of colliding beams followed by fixed-target runs are planned for the next few years with downtime only for change-over and minimal repairs. The first priority of the Collider program remains the improvement of the luminosity so that the exciting possibilities for new physics can be definitively probed in future runs.

Among the many recent successes we particularly note the following:

- The successful $\bar{p}p$ collider run at 900 GeV on 900 GeV which achieved peak luminosities in excess of 10^{29} cm⁻² sec⁻¹ at B0 and which promises further steady improvement.
 - A first look at physics at 1.8 TeV by the CDF group and encouraging preliminary data from E-710 and E-735.
 - Recent results from the '85 fixed-target run which include:
 - Charm lifetimes and branching ratios from E-691 which in many cases are the most accurate to date.
 - Significantly improved measurement of ϵ'/ϵ by E-731.
 - Improved understanding of same-sign dileptons from the E-744 collaboration.
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- High statistics study of large x_T physics from E-605.

- Definitive measurement of the energy dependence of charm particle production by E-743.

- Successful SSC aperture studies performed in the TEVATRON at the end of the Collider run.

We also note with dismay the inadequate budget within which the Laboratory must operate. In particular, the schedule for the high-priority D0 detector is in jeopardy due to insufficient equipment funds. It appears to be impractical to transfer these funds from the already starved fixed-target program.

CDF

The Committee expressed its great satisfaction with the initial physics run of CDF. They now have 33 nb⁻¹ on tape and have demonstrated the capability of the detector. We concur with the priorities they have stated in preparation for the next Collider run. This run should provide interesting Standard Model physics and could produce initial signs of new physics.

D0

The D0 group is now actively engaged in the construction of all components of the detector and is making good progress toward the completion of the detector. The collaboration is growing in size and the outlook for new physics with the D0 detector is bright. It now appears that substantial components of the detector will be ready for an engineering run in the first quarter of 1989. The components ready for this run should be the large-angle parts of the Central Detector, the Central Calorimeter, and a major fraction of the muon system. They will need a low-beta insertion for at least part of the engineering run. For the timely completion of the whole detector they need \$4 million in fiscal '88 in addition to the \$14 million now designated for them in that year. This additional funding cannot be provided by re-allotment of the equipment funds presently programmed for Fermilab. The timely completion of this detector is essential for the future program of the Laboratory.

The Luminosity Upgrade

The Fermilab TEVATRON Collider has the world's highest energy collisions. In the next few years experimenters at Fermilab will be able to search

for massive quarks up to 120 GeV and to explore the mass range up to 350 GeV for new weak vector bosons. The full exploitation of the discovery potential of the TEVATRON, however, demands an upgrade by a factor of 50 from the present design luminosity of 10^{30} cm⁻² sec⁻¹. This will effectively double both the mass reach of the Collider and the intensity of fixed-target beams. It is essential that work begin now to implement this upgrade by 1992. The upgrade will ensure a vigorous and unchallenged frontier program at Fermilab through the mid-nineties. Experience with the upgraded TEVATRON Collider will also be an important step in the development of detectors for the high luminosity environment of the SSC.

Computing and the Advanced Computer Program (ACP)

The Committee heard with interest a review of the status and future of computing resources at Fermilab. The aggressive response by the Laboratory to the computing demands from the physics program deserves strong encouragement. In particular, we recognize the Advanced Computer Program as an inventive response to the overwhelming demand for number crunching and data acquisition capability.

B-Physics

In response to the Committee's request, the Laboratory is organizing a B-Physics Workshop for November which will study the potential for doing high-sensitivity B studies at Fermilab. The Committee believes that the study of B-physics is very important and that the Laboratory may have great potential in this area. The experiments are difficult and will require innovative techniques in both fixed-target and collider modes.

Low-Energy Antiproton Facility (AMPLE)

The PAC was informed that the Laboratory has established a committee to study the physics opportunities and the cost of a low-energy \bar{p} facility. We consider this to be a wise response to the interest in such a facility expressed by some members of the community, and request that an interim report of the Fermilab AMPLE Committee be presented at the fall 1987 PAC meeting.