1976 SUMMER STUDY ON THE UTILIZATION OF THE ENERGY DOUBLER/SAVER

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For the first time since 1973, a summer study to consider future projects at Fermilab was held. The Energy Doubler/Saver has reached a stage of reality where serious planning for experiments and the upgrading of existing facilities must begin.

Summer studies to chart future physics and facility plans are a method that has been used in the past to focus the attention of both our users and staff on long-range goals. The summer studies of 1968, 1969, and 1970 provided major input for the design of our present experimental areas. In 1973, a study was held which focused on long-range accelerator projects. Here many of the ideas that went into the Energy Doubler/Saver and POPAE arose. All the summer studies except that of 1970 were held in Aspen, Colorado; the 1970 study was held at Fermilab.

It was generally felt that the 1970 study was not as productive as the others, mainly because it was difficult for people to concentrate their efforts on the topics of the study. As the Laboratory experimental program became more active, both outside users and staff found the "distractions" of the Laboratory too great. It became clear to us that if a summer study was to be successful, it had to be away from Fermilab where a concentrated effort could be mounted on our long-range problems without the many distractions (some very exciting!) of Fermilab.

The 1976 summer study lasted for two weeks (June 28 - July 9). It followed directly the summer Program Advisory Committee (PAC) meeting in Aspen. To maximize the interaction among the participants, the group was kept relatively small--about 40 people at any given time. The group contained about 15 Fermilab staff members and 25 outside users drawn from all over the country, as well as two participants from CERN.

Work at the study very soon divided itself into two broad categories. First was the use of the Energy Doubler/Saver as a colliding-beam device (either pp or $\bar{p}p$) and second was the use of 1000-GeV protons in the external experimental areas (Neutrino, Proton, or Meson Laboratories). Interest in the use of the Energy Doubler/Saver as a collider had been mounting all spring and a proposal had been received for studying pp collisions at very high center-of-mass energies, using collisions between the Doubler and the present Main Ring (P-491). At about the same time, a set of proposals (P-492, P-493) had been submitted to inject antiprotons into the Doubler to produce $\bar{p}p$ collisions at very high center-of-mass energies. A somewhat earlier proposal (P-478) had advocated building a small storage ring and colliding its protons with those in the Main Ring. These had generated a great deal of excitement and all were to be acted upon the PAC the week before the summer study. As reported by E. L. Goldwasser in the previous issue, the PAC rejected all of these proposals, thus giving the summer study a clean slate with which to work.

Although the PAC has rejected the specific proposals, they recommended that the uses of the Doubler as a collider be vigorously pursued. The 1976

Energy Doubler/Saver Progress Report and the above experimental proposals served as the major input for this portion of the study. The discussions were far-ranging and covered both the new physics that would be probed and its input to the design of the Doubler itself. For example, the number and geometry of the collision regions were discussed at length and all of us were impressed with the wide variety of options that were available. Although there were few firm conclusions, an attempt was made to better define the problems and to catalog the possible solutions. There were approximately 40 papers either written or promised that dealt with either pp or $\bar{p}p$ collisions.

While the colliding beam aspects had clearly caught everyone's fancy, there was still great interest in the utilization of 1000-GeV protons in the three external experimental areas. Groundwork has been started earlier this year with the organization of working groups in each of the three departments. These groups consisted of interested outsider users as well as Fermilab staff members and met at regular intervals right up to the time of the study. Their preliminary work served as an effective starting point for the study.

The interest in the Neutrino Laboratory centered on the physics that could be done with the higher-energy neutrino beams that the Doubler would provide. This is probably one of the most exciting fields to explore at Doubler energies and a great deal of the discussion was centered on how to provide separate targeting for the neutrino, muon, and hadron beams that now exist but have considerable interference. Specific geometries were proposed that could solve this problem. As in all previous summer studies,

the adequacy of the neutrino shield was much discussed and the same inconclusive conclusions reached.

A significant portion of the Proton Laboratory program is already being developed with 1000 GeV in mind. The high-intensity pion beam is being built as a 1000-GeV transport and will be able to target the full Doubler intensity. The planned Proton-Center charged-hyperon facility would also be able to utilize Doubler energies without modification to explore hyperon production at medium ranges of the Feynman variable x. The Proton Laboratory, with its unique ability to have multiple target stations utilizing 1000 GeV, was recognized as the place where new experiments might uncover unexpected phenomena at 1000 GeV.

There was renewed interest in the Meson Laboratory program at 1000 GeV, perhaps because the 1975 Energy Doubler/Saver Design Proposal mentioned bringing 1000-GeV beams to the Neutrino and Proton Laboratories, but did not mention the Meson Laboratory. It was pointed out that a very significant increase in the intensity of the present secondary beams could be achieved with no other modifications if the proton energy were raised to 1000 GeV.

Although modifications to the Internal Target Area and what a new Quark area might look like were both discussed, it was really the colliding-beam potential of the Doubler and its 1000-GeV proton use in the three external areas that the study concentrated its efforts on. It is planned to have the summer study proceedings available in the fall.