MESON II WORKSHOP

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Introduction

The second and concluding Workshop - Meson II - on the upgrade of the Meson Area took place at Fermilab on April 14. Approximately seventy-five Users attended the all-day session.

Since the first Workshop in February, a number of working groups have met regularly to consider various aspects and possibilities for making the Meson Area facilities competitive with the CERN North Area.

In his introductory remarks, John Peoples set an optimistic tone for the Workshop in announcing that Dr. Wilson has allocated approximately $600,000 for construction in the Meson Area in FY 78. This will cover construction of a splitting station and new target train to allow an independent proton beam and target for M6, an annex to the Meson Target Hall for assembling and monitoring the more-sophisticated target systems envisaged after Mesopause, completion of the M1 tunnels to accommodate a very high intensity pion beam, and minor modifications to M6 to accommodate a 400-GeV upgrade.

Timothy Toohig reviewed the historical development of the Meson Area as background for the Workshop development. He pointed out that the Meson Area had been designed and built to operate with the accelerator as originally conceived at 200 GeV. Over the years, the Switchyard capability was increased, first to 300 GeV in 1973 and then to 400 GeV in 1975. The production angles of the secondary beams were, however, still those chosen

for 200 GeV. In the summer of 1977, the target train was modified to permit variation of the targeting angle to favor one beam line, while reducing the available flux in the other beam lines. In the same period, the secondary beam lines were gradually increased in energy to match the primary energy, except for the M6 line. The M6 line was limited to 200 GeV because of constraints in the enclosures. In M2, the controls and shielding were improved at the same time to allow targeting of approximately 10^{12} protons per pulse at the target station in the Detector Building. At this juncture, all that could be done adiabatically had been done.

The rationale for these construction projects is spelled out in "The Fermilab Meson Area: Proposal for 400-1000 GeV Upgrade," March, 1972.

Targeting: M1, M6 Independent Target

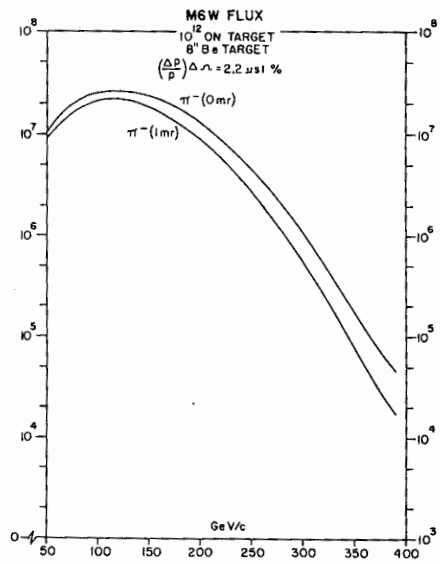
Alan Jonckheere reported on the design of an independent targeting system for the major beam lines. He pointed out that a factor of 4 to 5 in flux had been achieved in practice in the M1 or M6 beam lines by reducing the targeting angle to less than 1 mrad using the new targeting-angle magnets. It is desirable to have the capability of simultaneously having high flux in M1 and M6 by providing independent targets. The geometry of the Switchyard channel to the Meson Area is such that splitting the proton beam is trivial. Three manholes, F1, F2, F3, are separated from one another by 500 ft; from F3 to Meshall is 500 ft. With all this drift space, a single 3-m electrostatic system running at modest voltage in F1 and two Lambertsons in F3 suffice to provide an independent production target for M6. Some modest construction is required between F3 and Meshall to accommodate the split

beam. The Accelerator Division has agreed to installation of this split during Mesopause. At a later date, an electrostatic septum in F1 with Lambertsons in Meshall will provide an independent target for M1 and a direct proton beam to M2.

Details of the split are laid out in a report distributed at the Workshop, A. Jonckheere, "Meson Primary Proton Beam Targeting Upgrade," March, 1978.

M6: 400-GeV Upgrade

Ernest Malamud reported on plans for the M6 beam line. It is planned to increase the peak energy of the M6 line to 400 GeV by the use of superconducting Energy Doubler/Saver magnets. The beam will retain its character as a high-resolution beam with mass tagging. The figure below indicates the fluxes to be expected from M6 after the Mesopause. A more detailed report is available as "M6 Upgrade," E. Malamud et al., April, 1978.

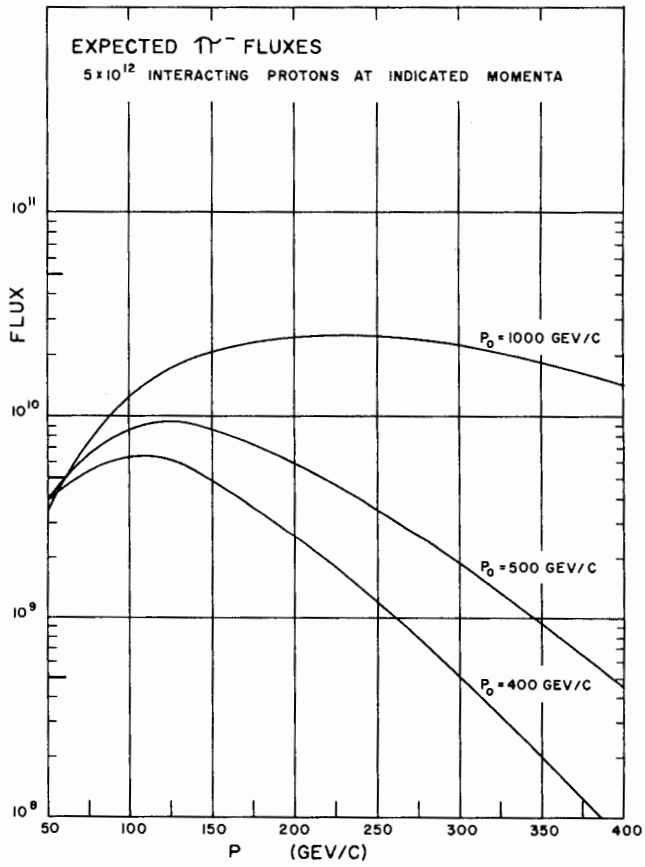


Estimated pion fluxes at several angles in the M6 beam line.

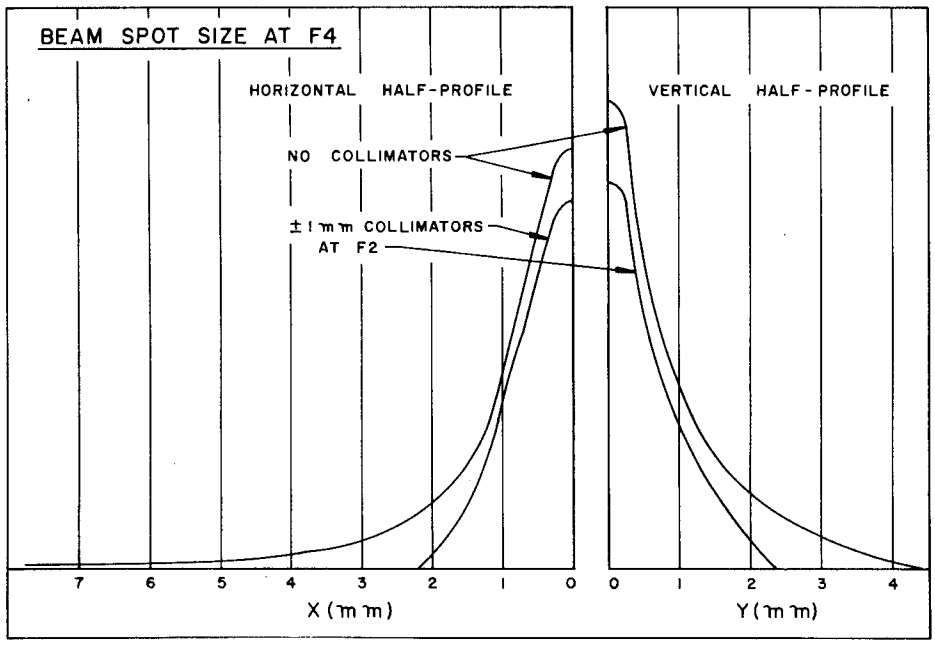
M1: High Intensity Pion Beam

Winslow Baker, David Carey, and Robert McCarthy described plans for the M1 beam line. A working group under Baker's direction has evolved a very high intensity pion beam design based on a new principle developed by Karl Brown of SLAC and applied by Carey to this case.

By the use of a periodic lattice incorporating sextupoles as major elements, a momentum acceptance $\Delta p/p = 24\%$ is achieved. A beam energy of 400 GeV is possible in the existing tunnels. Because of the unique character of the beam, fluxes of greater than 10^{10} π^-/pulse are attainable with very small spot sizes. The graph below illustrates the π^- flux as a function of beam energy, while the figure on the next page illustrates the spot size at the high-energy target station at 1000 feet.



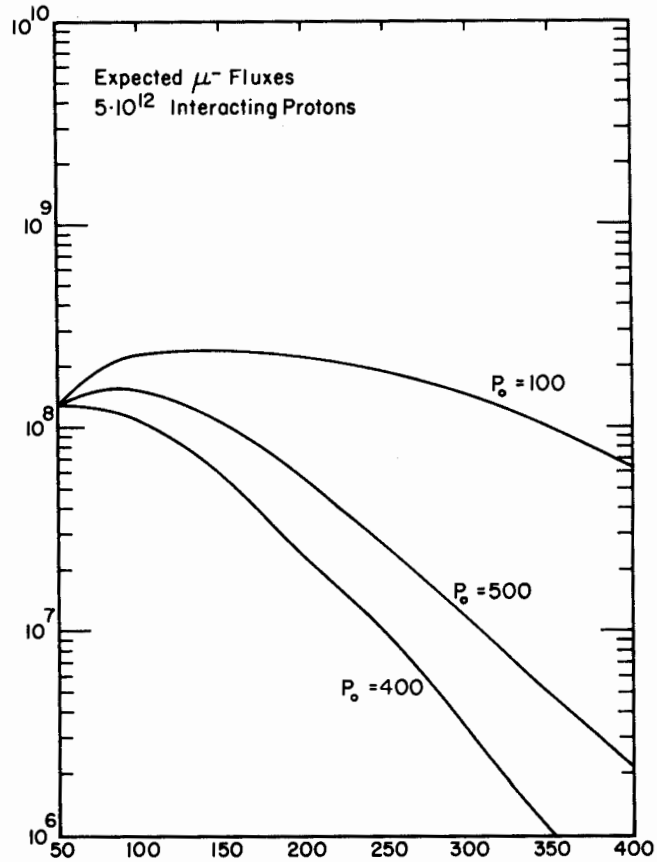
Estimated π^- flux as a function of beam energy.



Beam spot size at F4.

Preliminary studies, illustrated in the graph on the next page, indicate the possible utility of the beam as an alternative muon channel.

Present plans call for completion of the M1 civil construction during the Mesopause, with provision for an independent M1 target incorporated into the new target train. The beam would be only slightly modified from its present configuration coming out of the Mesopause in order to complete the presently installed experimental program. Procurement of the necessary elements would take place during the running of this program, with installation of the full high-intensity design envisaged for approximately 18 months after the Mesopause. Funds for the implementation are requested for FY 80.



Estimated μ^- flux as a function of beam energy.

A detailed design report is available as "A High Flux M1 Beam," W. Baker et al., February, 1978.

M2: 10^{12} ppp and Hyperon Move

On the day of the Workshop a new record intensity of 7×10^4 ppp was targeted successfully in M2. Plans for M2 include provisions for targeting up to 5×10^{12} protons per pulse in the Detector Building target station

contingent on a review of residual activation and shielding design. The neutral hyperon facility will be moved approximately 50 ft downstream of the Detector Building to accommodate more extensive experiments in the upstream target location.

M3: Polarized Protons and $\bar{p}$

Akihiko Yokosawa reported on the activities of an enthusiastic working group who considered a polarized proton beam and a $\bar{p}$ option in the M3 line. Construction of such a facility is tentatively envisaged for FY 80 budget submission. A detailed report is available as "A Polarized Beam for the M3 Line," A. Yokosawa et al., January 31, 1978.

Left Bend: Superconducting Installation

Russ Huson and Roger Dixon reported on plans to install Energy Doubler/Saver dipoles in the Left Bend during Mesopause. An access into the Switchyard to accommodate the 22-ft magnets will be constructed during the May-June maintenance and development period. Two ED/S dipoles will be installed in a zero-deflection arrangement to be operated prior to Mesopause. Based on the success of these tests, the upstream conventional magnet bend string will be removed during the August and September shutdown and ten ED/S dipoles installed in their places. With shielding in the tunnel, the installation of the twelve downstream dipoles can go on during Neutrino-Proton operation. Target dat for operation is before the February 15 scheduled end of the Mesopause.

Conclusion

The projects discussed at the Workshop are the beginning of the Mesopause work. The design work has proceeded rapidly with the aid of enthusiastic help from many Meson Area users. The construction work that is now beginning will result in a revitalized area capable of extending to the 1000-GeV regime the wide range of experiments that has always been characteristic of the Meson Area.