FUTURE OF THE MESON LAB

R. Rubinstein
Brookhaven National Laboratory

1. Present Status

The Meson Lab was built as a 200 GeV/c experimental area to provide a variety of hadron beams which would be used, at least initially, for the "standard" experiments of a new momentum region (total cross sections, elastic scattering, etc.). The financial investment in the Meson Lab is ~ $15 M, exclusive of the proton transport.

At present, protons up to 300 GeV/c momentum, and \( \geq 10^{12} \) protons/pulse can be brought to the Meson Lab Target. The secondary particle beams are M1 and M6 high quality pion beams which are capable of momenta up to \(-220\) GeV/c, and both of which have branches; a neutron beam M3; a \( K^{0}_L \) beam M4; and a diffracted proton beam M2. This latter, which has been strongly recommended in previous Summer Studies, has an intensity \( \sim 10^{10} \) protons/pulse, with momenta up to 300 GeV/c, and can be used to produce tertiary beams such as hyperons, \( K^0 \), etc.

It is relevant to note here that the Meson Lab experimental program is committed for the next 2-3 years, making it hard to undertake large construction changes in that period.

2. Future Problems

The proton transport to the Meson Lab is adequate for 300 GeV/c. If the accelerator runs at 400 GeV/c, changes will have to be made, and at 500 GeV/c these changes will probably be substantial. The Meson Lab earth shielding is adequate for 300 GeV/c, but with higher momenta a muon problem will probably develop in the experimental area itself; this could be alleviated by running at reduced intensity, but this would seriously affect the number of experiments.

Thus, if we assume that the accelerator will soon operate generally in the 400-500 GeV/c range (and later even at 1000 GeV/c), then we will have the problems of (a) extensive proton beam modification, (b) inadequate muon shielding, and (c) the loss of the diffracted proton beam and its tertiary beams. A diffracted proton beam has almost the same momentum as the incident proton beam, so that considerable upgrading of this beam would be necessary. In addition, the present production angle (1.75 mrad) should be reduced for increased incident momentum, otherwise the particle flux will be reduced, and this is not a simple change.

3. Comment on Secondary Beams at Other Accelerators

If we look at other accelerators, it is interesting to note that much work is done with secondary beams of momenta less than half the accelerator momentum. There is no reason at present to suppose that this will not be true at NAL, leading to the conclusion that even when the accelerator is running at 400-500 GeV/c, much physics will still be carried out in beams of momentum 200 GeV/c or lower.
4. Recommendation

Due to the large investment in the Meson Lab, the nontriviality of changing it, and the usefulness of 200 GeV/c beams:

LEAVE IT ALONE!

This applies also to the present proton transport. It follows that high energy beams in the 400-500 GeV/c range, or even 1000 GeV/c, should be built elsewhere on the NAL site. (This is discussed in other summer study reports.) However, if experience at other laboratories is any guide, the needed number of such higher momenta beams will be reduced due to the availability of 200 GeV/c beams in the Meson Lab.

5. Implementation

The operation of the Meson Lab with 300 GeV/c protons while the remainder of the laboratory is operating at 400-500 GeV/c is possible if a "front porch" is put on the accelerator cycle, as shown in Fig. 1. The "front porch" is at 300 GeV/c, and beam is extracted at that time for the Meson Lab only. There will be an increase in repetition time due to this, though not large fractionally, and also an increase in required main-ring magnet power, but these small disadvantages seem worth the advantage of keeping the Meson Lab in operation without having to make large changes in it. The "front porch" spill will have rf structure, but this is probably not a problem for many experiments.

Discussions with accelerator and extraction experts leads to a conclusion that the problems of the "front porch" and the necessity of pulsing the extraction system twice per cycle are not excessive. Costs of the needed extra components are expected to be in the $10^5 range.

Acknowledgment

This report is the result of discussions on the Meson Lab future with many other summer-study participants.