SECONDARY BEAM TRANSPORT EQUIPMENT

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In order to get an estimate of costs of beam transport equipment, the design of several beams in the UCRL and CERN study was studied. In addition, use was made of the scaling considerations outlined by Keefe and Trilling in the UCRL studies.

The sizes of magnets shown should be considered very preliminary because not enough calculations have been made to optimize these parameters. Despite the wide range of energies that may be usefully employed, the magnet sizes needed do not vary greatly. This is basically due to the fact that the high energy particles are concentrated in a smaller production angle than the low energy ones. Therefore a given length and bore of quadrupole can be used at short focal lengths for low energy and long focal lengths for high energy particles. A reasonable acceptance of the total particles is obtained in each case.

Since the low energy beams are then shorter than high energy ones, a larger bending angle is needed for the same dispersion at a focus. Thus bending magnets lengths are also reasonably independent of energy.

From major target stations where more than one beam is

to be used from each target, only a small transverse distance is gained by using other than 0° production for one of the beams. The transverse distance so gained does not basically alter the difficulties in getting two completely independent beams from one target. To get cost estimates we have assumed the target will be followed by 3 - 10 ft magnets operating at about 17 kg to separate the EPB from secondary beams and that all beams will traverse these magnets. A 100 GeV π^+ beam will be 1.3" from the EPB at the end of these magnets. This is probably about as high an energy positive beam as it is reasonable to use with the proposed target magnets.

Several schemes are advanced in the CERN and UCRL studies for independent momentum variation of beams from the same target station. These are complicated and, I believe, impractical in the beginning year of operation when reliability will be the chief factor in determining useful physics output.

The following beams were considered:

<u>Target Sta. 1</u> (10^{12} pps at 200 GeV)

Target A

a) A high energy beam (+ to 100 GeV, - to 170 GeV) with a Y going to two experimental locations.

b) ν facility

c) Neutral beam.

Target B

a) Quark seach facility (400 GeV equiv. mom.)

b) RF separated beam (~50 GeV)

Target Sta. 2 (10^{10} pps @ 200 GeV or 10^{12} pps @ 100 GeV)

Target A

a) Medium energy (± to 100 GeV) with Y to two experiments.

b) Low energy beam

Target B

a) Medium energy

b) Neutral beam

c) Low energy

Internal Target (10^{10} pps, 200 GeV)

a) Medium energy with Y to two experiments

b) Low energy beam.

Low Intensity Stations 1 and 2

a) Low energy beam at ~15 mrad.

(One station should be reserved for equipment testing.)

Recommended Magnets for Beam Handling

40 Bending Magnets	4" x 10"	120" long	15C	25H
40 Quadrupoles	4"	x 90" long		
30 Quadrupoles	4"	x 120" long.		

Above list does not include ν facility magnets

ν Magnets

30 Quadrupoles 8" diameter

Target Station Magnets

3 targets should have 3 120" magnets in series with the following apertures:

a) 3" x 3" total of 3

b) 4" x 6" total of 3

c) 5" x 10" total of 3

The target to be used for the neutrino facility will need larger aperture magnets.

Triplets are probably a better choice than doublets to obtain maximum particle acceptance at 0° production because of the large horizontal vertical asymmetry for doublets and the sharp drop in production with angle. In this case the quadrupole sizes quoted are probably not realistic. More likely 60" quadrupole combined with 120" quadrupoles to form a triplet would be reasonable.

Clearly, more variety is needed than is quoted here, but the bulk of the magnets will probably be near these sizes; hence this should be reasonable for a cost estimate.