



Fermilab

p̄ Note #362

Booster to Debuncher Line

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Booster to Debuncher Line

The line connecting the Booster to the Debuncher is intended to provide a low intensity source of 8 GeV protons for injection into the Antiproton rings during times when the Main Ring is unavailable. The first use of this beam will be primarily during the long shutdown in 1985. ~~of 1985~~. During that period the commissioning of the cooling systems in the Debuncher and Accumulator Rings will be completed. The desired properties of this beam are:

1. A well defined 8 GeV beam emittance $\leq 10\pi$ mm-mrad, $\Delta p/p \leq 0.2\%$, $I \leq 10^9/2$ sec. pulse, for optical tune up of the rings;
2. An 8 GeV beam as above, $I \leq 10^7/2$ sec pulse, for stochastic cooling; and
3. A proton beam of 7.9 GeV or less with $\Delta p/p \leq 3\%$ and $I \leq 10^7/2$ sec pulse for debunching.

Two specific requirements which have to be built into the design are, the Booster must operate at the standard intensity of $2-3(10)^{12}$ protons per batch and the particle beam intensity in the line must be less than 10^{11} particles per batch as soon as the beam traverses South Booster Road.

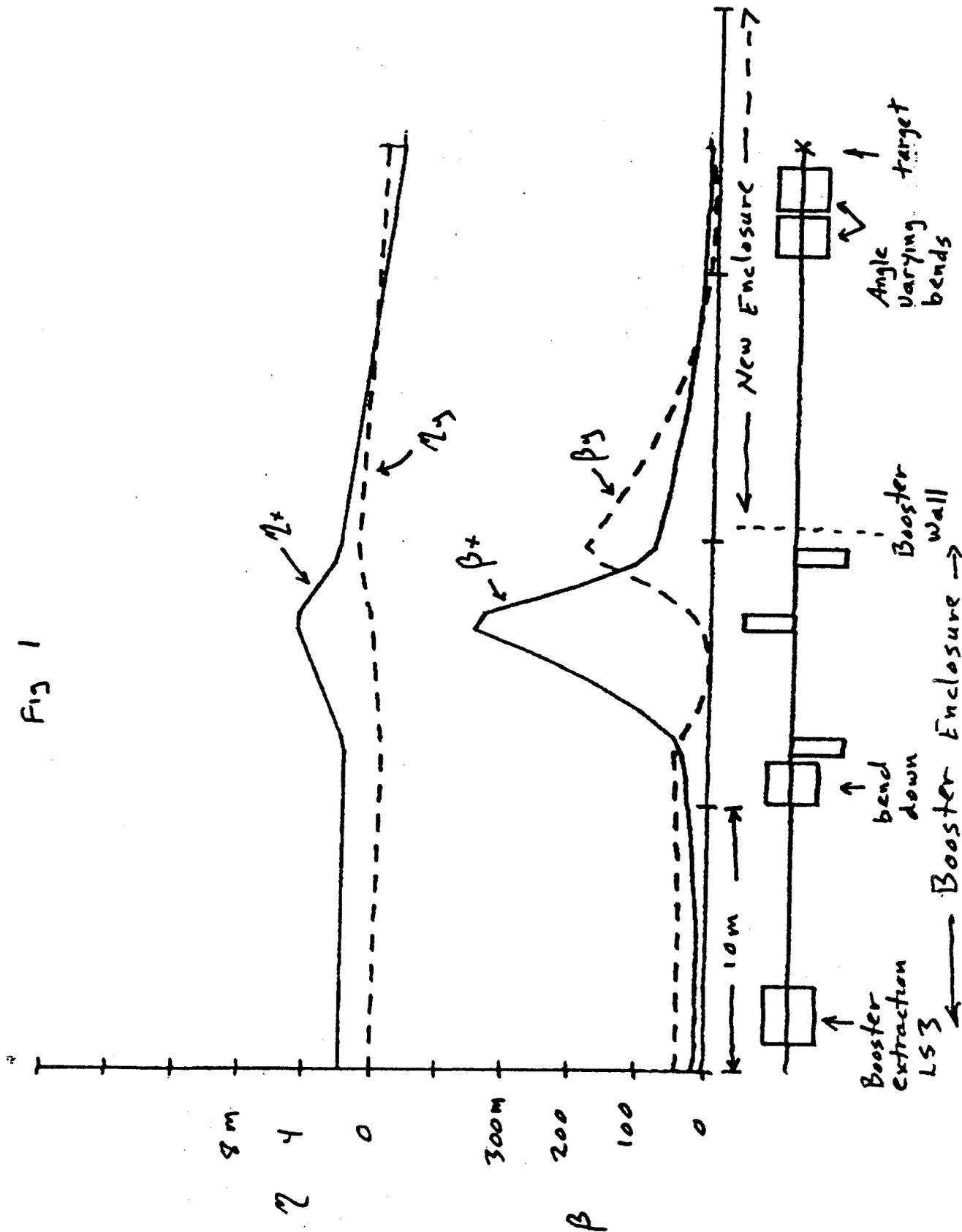
In order to both reduce the proton beam intensity to radiologically safe levels and to be able to vary the intensity into the Debuncher while leaving the Booster intensity unchanged this design extracts beam from the Booster onto a target and then transports scattered protons to the Debuncher. Specifically, one Booster batch is extracted at LS3 with a vertical septum similar to MP-01. It is bent up by 50 mrad. At an elevation of 728' it is bent down by 60 mrad by a 5 foot EPB dipole. Three quadrupoles run in series focus the beam to <5 mm spot on a target. By varying the field of dipoles immediately in front of the target as well as the EPB, the targeting angle may be changed from 10 mrad down to 60 mrad down (see Fig. 1). After passing through the target the primary beam continues downward into a dump. A fixed opening collimator forms a 10π mm-mrad, level beam. By varying targeting angles the collimator will admit a beam intensity from $<10^6$ to $<10^{11}$ per Booster batch. The scattered beam is then bent up and leveled off at an elevation of 732.5' and transported to the Debuncher enclosure (Fig. 2). This accomplishes two purposes. It provides good momentum definition and it allows injection into the Debuncher vertically in a manner similar to the antiproton injection line. The approximately 25 meters following the target also contain four quadrupoles which are used to adjust the beam parameters in order to allow it to be transported some 140 meters through an evacuated beam pipe to the Debuncher enclosure without significant loss. During this

140 meters, the beam first passes under the existing (and newly increased) utility corridor, South Booster Road and then Indian Road as well as parking lots to be added.

This design builds an enclosure between the present Booster enclosure and the existing utility corridor which contains a target vault. The length of this enclosure is determined by the space needed to get a beam which can be transported through a beam pipe which runs at least under the utility corridor. This cannot be done within the Booster enclosure. The target vault was incorporated into the new enclosure in order to reduce the beam intensity to a level which is compatible with the available shielding between South Booster Road and the Rings Enclosure. The system as designed guarantees that no more than 10^{11} protons can be transported beyond the target enclosure. Steel shielding has been put above the beam pipe to allow continuous beam loss of $<5(10)^{10}$ protons per pulse. Beam toroids in the target enclosure and Debuncher enclosure will give a radiation trip if they measure a loss of $>5(10)^{10}$ particles. The shielding is adequate for approximately 400 trips per hour. Should this be exceeded, Booster extraction will be turned off. Resumption of operation will require a permit from the Control Room.

SCALES: MIN. BETA 0.00 ETA -20.00 LATTICE FUNCTIONS
 MAX. 500.00 20.00 BOOSTER TO TARGET

Fig 1



SCALES - MIN. BETA 0.00 ETA -20.00
 MAX. 500.00 20.00

Fig 2

