A POSSIBLE RECONFIGURATION OF THE SSC TEST BEAMS FACILITY PROVIDING 1 TeV AND 20 TeV PROTON TARGETING AND THE POSSIBILITY OF HIGH INTENSITY NEUTRALS

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Introduction

In the Conceptual Design Report (CDR) the Test Beam Facility was aligned with the clockwise injection line into the High Energy Booster from the 100 GeV Medium Energy Booster (MEB). This arrangement provides the possibility of test beams using 100 GeV protons in the event that the MEB and Test Beam Facility were completed and commissioned substantially earlier than the 1 TeV High Energy Booster (HEB). Another factor influencing this arrangement was the apparent consensus that for test purposes there is no reason to use particles with energies above 1 TeV. The Facility as envisioned in the CDR is illustrated in Figure 1 with the injection angles and separation of the HEB ring and Collider exaggerated for clarity.

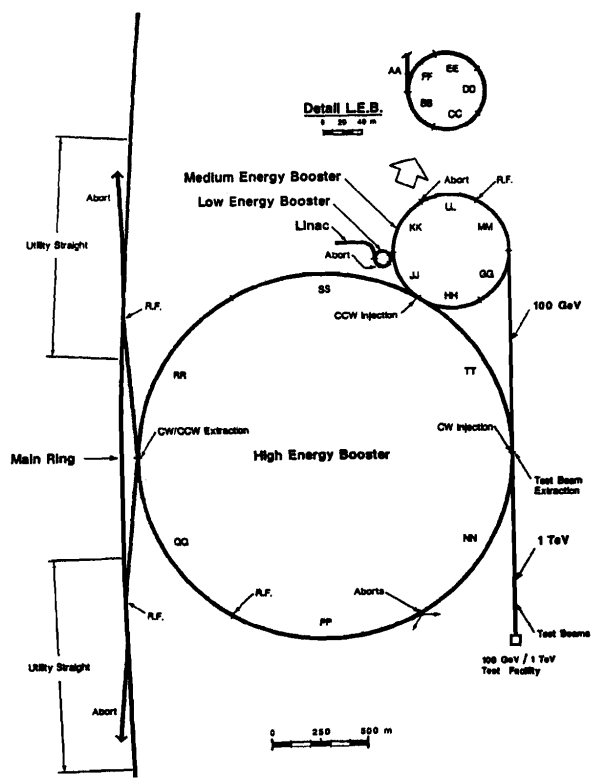

Figure 1

On examination there are several drawbacks to the proposed arrangement. The extraction line from the MEB shares an enclosure with the HEB at the injection point for the HEB. Operation of the extraction line could then interfere with construction and installation of the HEB because of the radiation hazard involved. The 100 GeV option for the facility does not seem to be, therefore, a viable early option.

"Civilizing" the otherwise undeveloped, relatively remote area where the Facility would be located would involve substantial costs for roads, utilities, monitoring and control systems, etc. If the Facility were sited in an already developed area these ancillary costs could be substantially eliminated. In addition, based on the CDF experience, it is desirable to have the Test Beam Facility relatively close to the detector fabrication site, presumably the Heavy Works Building, in the opinion of the participants in the 4-pi detector group at Snowmass.

A new factor that emerged at Snowmass was the desire for test beams with energies in excess of 1 TeV to study some aspects of calorimetry which don't seem to extrapolate simply from data below 1 TeV.

Step 1: Relocation of the 1 TeV Facility

Many of the drawbacks cited above could be alleviated, at the expense of some complication of beam handling, by moving the Test Beam Facility 180 degrees around the HEB. It would then use the same extraction straight section as is used for injection into the Collider Ring. Figure 2 is an elevation showing the relative locations of the Collider Ring, the HEB, and the transfer line between them at this location. The downward projection of the 1 TeV transfer line, required by the vertical offset of the HEB and Collider, leaves open the possibility of a second, horizontal branch of the 1 TeV extraction line. By reversing the field of the Lambertson extraction magnets the 1 TeV protons could be pitched into a transport line for the Test Beam Facility. Assuming this mode of extraction, a reconfigured Test Beam Facility is illustrated in Figure 3.

This reconfigured Test Beam Facility has several advantages over the CDR configuration. First, it places the Facility in reasonable proximity to the Heavy Works Buildings where the elements to be tested would, presumably, be assembled. Personnel working on the assembly would be able to monitor and take part in the tests more easily. Second, it results in an economy of utilities and roads, making use of those already required for the Collider Ring facilities like the RF and injection lines. Finally, it results in a concentration of the radiation burden and radiation safety surveillance concerns. The primary abort lines and dumps already exist in this area, and access to the region of the extraction and injection line, which are inherently radioactive, must be monitored and controlled. With the test beams also in this vicinity rather than in a different, remote area, the problems of surveillance and control (and the size of staff required) are lessened.

Step 2: >1 TeV Test Beams

The reconfiguration of the Test Beam Facility described above opens the possibility of providing particles of energy >1 Tev, derived from 20 TeV protons, in the same facility. Figure 4 illustrates the Injection/Abort region of the Collider Ring. A Lambertson magnet dogleg is shown in straight section Q for the counterclockwise abort. The clockwise beam as designed passes undeviated across this region. If a similar Lambertson dogleg were installed in the clockwise beam, a 95 microradian vertical deflection

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* Operated by Universities Research Association for the U.S. Department of Energy.

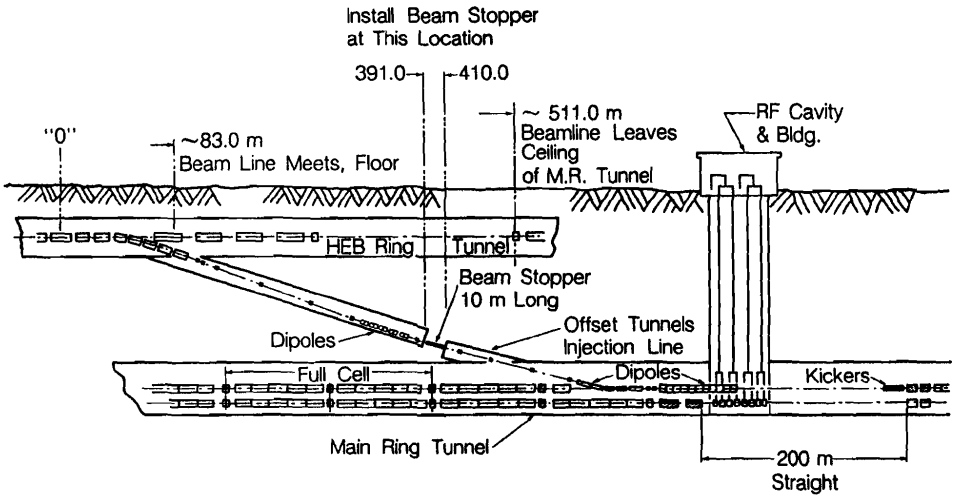

Figure 2

would inject protons into the field-free region of the septum. An extraction device would have to be placed at the same relative location as the kickers in the abort line. The collider ring magnet aperture does not allow for traditional slow extraction with use of a wire septum, but an appropriately bent crystal could be used as the extraction device to channel halo protons into the Lambertson aperture. Extraction using a bent crystal is being done at the Synchrophasotron at Dubna, and there has been some analogous success with providing protons into the M-bottom line at Fermilab. With no further bending the resulting 20 TeV proton beam line would be separated from the Collider Ring beams by approximately 60 meters at the position of the counterclockwise RF. Recalling Figure 2, this extracted beam, assuming the CDR vertical offset, would still be approximately 7 meters below the 1 TeV proton beam facility at the position of the Test Facility. By appropriate steering both the 1 TeV and 20 TeV beams could be directed into the same Facility as illustrated in Figure 5.

Step 3: High Intensity Neutral Beams

A neutral beam from a low-beta IR is described in a paper by Harrison elsewhere in these Proceedings. If such a beam were derived from the low-beta IR at Sector S, adjacent to the Injector in the CDR, it would approximately intersect the undeviated 20 TeV extracted proton beam at the location of the Test Beam Facility described in steps 1 and 2, above. This is illustrated in Figure 6. The availability of an intense, high energy neutral beam would add another dimension to the potential usefulness of this consolidated Facility.

Conclusion

By relocating the 1 TeV Test Beam Facility as proposed in the CDR a combined 1 TeV/20 TeV Test Facility could be provided, as illustrated in Fig. 5. This modification would alleviate some of the drawbacks of the CDR design and respond to some of the requests of detector groups at the Snowmass Summer Study. At the same time it could result in significant advantages for construction and operation. This combined Facility by virtue of its location could then be further enhanced by the addition of neutral beams from an adjacent low-beta IR, as illustrated in Fig. 6.

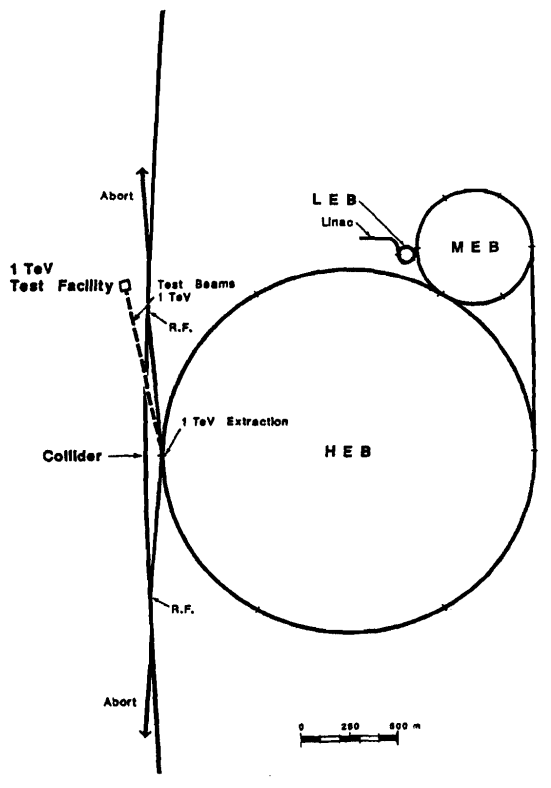

Figure 3

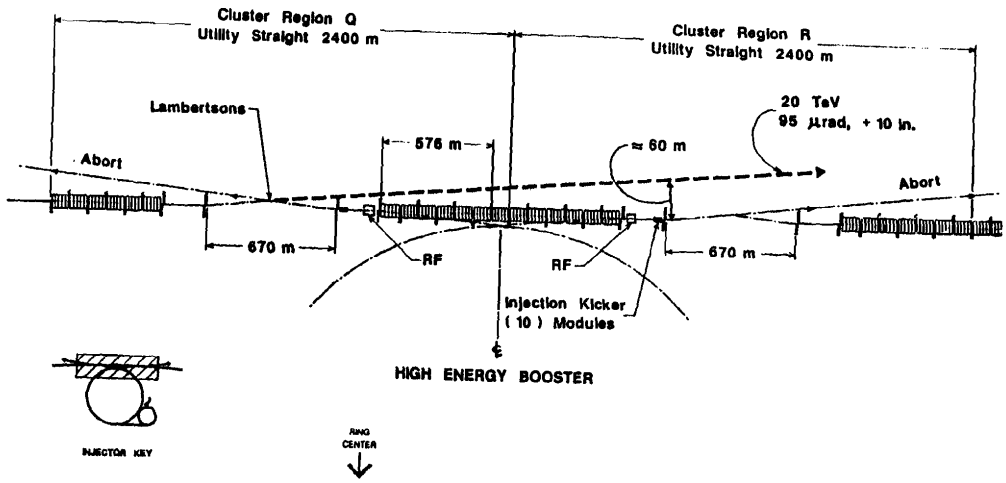

Figure 4

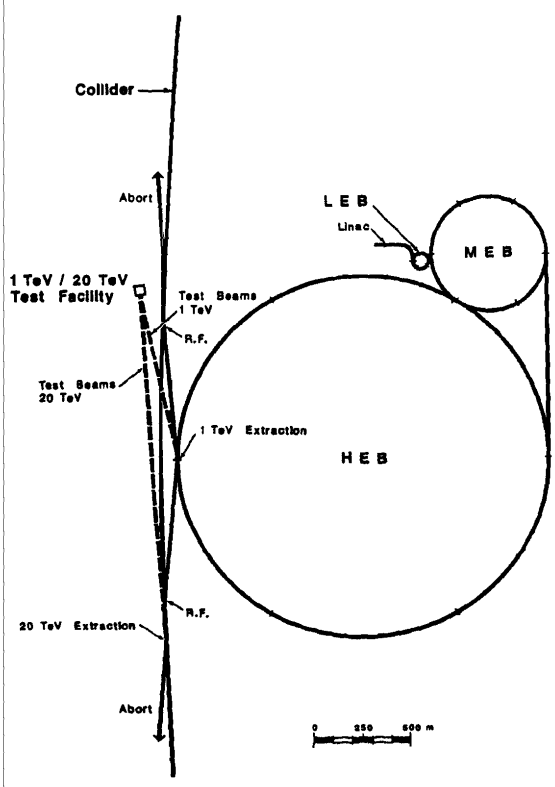

Figure 5

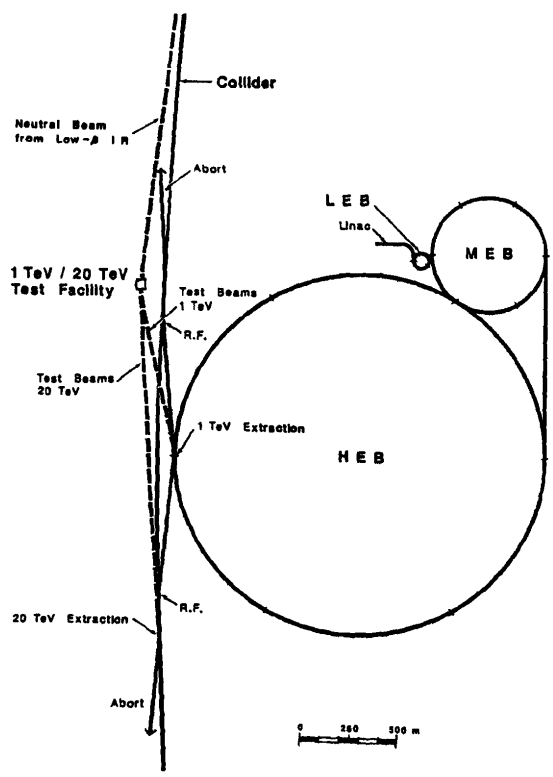

Figure 6