Cluster Parameter Meeting Notes 10/24/85

J.M. Peterson

Attendees: Bintinger, Chao, Groom Harrison, Johnson, Limon (chair), McAshan, Peggs, Peterson, Schachinger, Stork, Talman, Toohig

The "long" (Garren) and "short" (Peggs) versions of the "2,4" clustered layouts were compared from several points of view. The two designs considered by the clustered IR Study Group 10/18/85 are described in SSC-N-49. Some further developments have a occurred.

Peggs reviewed the short version. The utility straight U_1 has an overall length of 800m and and inter-doublet free space of 520m, which in U_2 could be increased to 620m. In this design the first ferromagnet splitter is between Q5 and Q6, about 200 meters from the IP, which has the advantage of no second β peak. However, it has the disadvantages of more long-range beam-beam tune shift, less sweeping of beam-beam reaction products (and therefore perhaps twice as many μ-mesons downstream), and more steering in the common quads beyond the triplet (due to the crossing angle). The inter-crossing separation increased from 1.93 to 2.1 km.

Garren reviewed the long version. The new long version uses 6.4T and the full-cell type of dispersion suppressor. Inter-crossing distance is 2.35km, each straight section is 1.3km, and the inter-doublet free space in the utility straight is 830m. The bend angle between crossings is 67mr, giving an inter-crossing off-set of 79m. Machine circumference is 91.9km.

Groom emphasized the desirability of having the beam splitter magnet as close to the IP as possible. The decay probability per unit length for a π-meson of energy E is (20Tev/E)/1118km so that the μ-flux is roughly proportional to the distance to the splitter. Also desirable is a long space free of optics in a high dispersion region for collimation and scraping.

Regarding the position of the magnets in tunnel enclosure, one argument is that the radiation spray from beam loss in the arcs reaches the outer wall sooner when the magnets are against the outer wall. However, Peterson pointed out that for the magnets center-line at 45cm from the inner wall of 10-foot diameter tunnel the tangential loss path to the outer wall is only 128 meters longer than for magnets at 45cm from the outer wall (238m vs 110m). Toohig stated that another reason for having the magnets at the outer wall is the vehicular access from the tunnel to the refrigerator stations, which are favored to be inside the ring for radiation reasons.

Toohig also showed that the detector garage need not extend more than about 30 meters from the beam-line. Groom showed calculations giving the radius of the μ-meson beam from the neighboring IP as no more than 5 meters. Thus the criterion that the cluster geometry should provide a minimum inter-IP offset of 40 meters was developed.

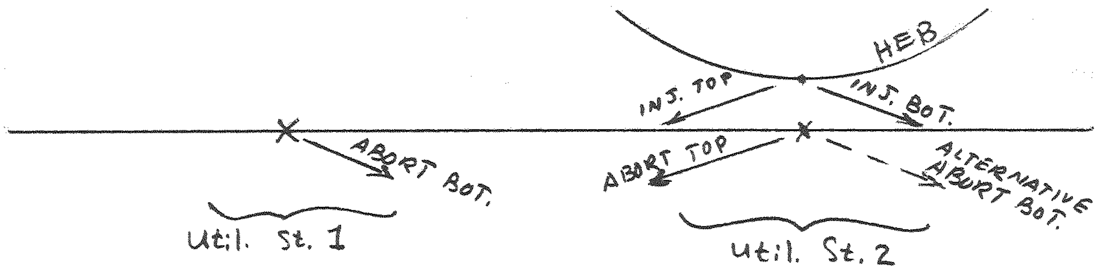
There was no support for the argument that the reaction products from one IP should provide a test beam in the garage of an adjacent IP. There are other schemes for providing such test beams.

Harrison discussed injection schemes. Assumed:

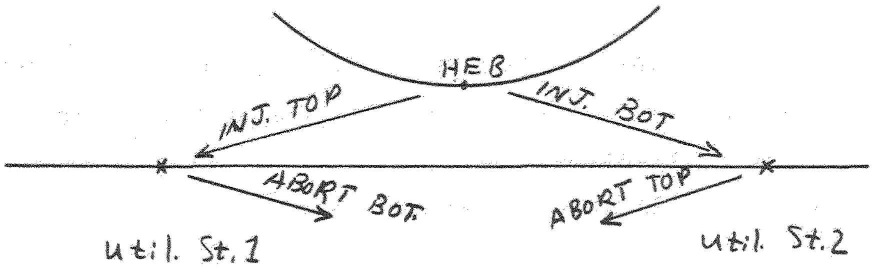
1) HEB and main ring are independently operable, are separated by at least 6 meters horizontally, and are at different levels.
2) Injection is from the inner side, and abort to the outside.
3) Beam manipulation is confined to warm regions of the utility straights.
4) HEB is a generic 1Tev machine with horizontal dispersion, no vertical dispersion, and β_{max}/β_{min} on the order of 100/30 meters in the extraction system.

Topologies considered:

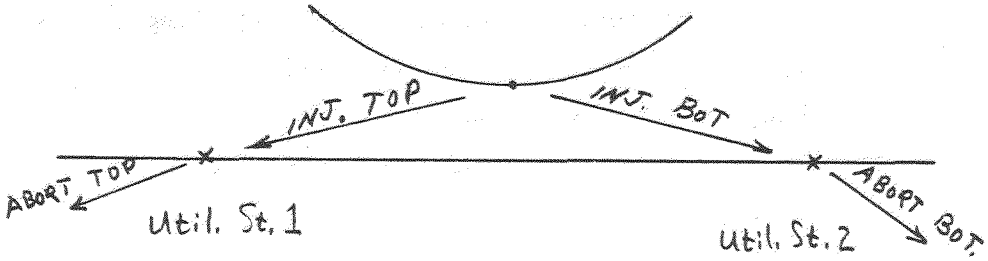
1) Both injections into same utility straight.



2) Injection into separate utility straights.

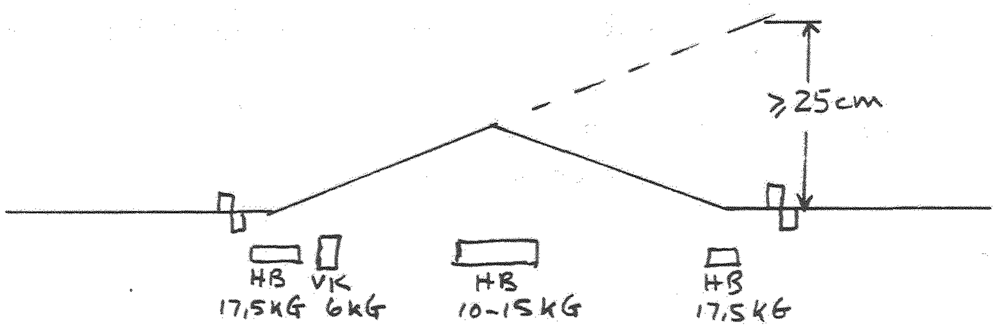


3) Injection with adjacent abort in separate utility straights.



Length requirements for Abort:

Criterion: beam separation of $\geq$ 25cm at doublet quad:



1) At L = 500m, θ = 560 μrad, θ_k = 125μrad, Δ_y = 25mm
Looks ok.

2) At L = 400m, θ = 650 μrad, $\theta_k \gtrsim$ 250 μrad
Looks ugly, but possible.

Note that with a 25cm offset, the abort beamline transverses the cryostats of the doublet quads.

Conclusion

1. Injection line can be easily matched if phase advance is $\geq 4\pi$. If less than 4π, there could be limitations. If less than 2π, there are severe restrictions.
2. Case 2 (or 3) looks relatively efficient.

Case 1. (both injections into same utility straight)

a) Long version, injection ok.

b) Short version, injection very hard (impossible?) because of matching, separation, kicker problems.

c) Long version, abort ok.

d) Short version, abort ok, but one must be moved to other utility straight.

Case 2. (injections into separate utility straights) Both long and short versions ok. Injection line is only slightly longer (200-400m) than in case 1.

Case 3. (injection with adjacent abort in separate utility straights)

a) Long version ok

b) Short version probably ok

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