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Dynamic Aperture of the Collider Injection Lattice with Certain Dipoles Removed

T. Sen and Y. Yan

Accelerator Design and Operating Division
Superconducting Super Collider Laboratory*
2550 Beckleymeade Avenue
Dallas, TX 75237

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Abstract

With careful dispersion match, computer simulation shows that taking certain dipoles out of the collider's latest design will not harm the dynamic aperture.

1.0 REMOVAL OF DIPOLES

We have performed tracking for the collider injection lattice (cluster regions included) with short dipoles removed from specific locations in the original lattice to leave enough space for cryogenics and possibly other purposes. A total of 72 short dipoles were removed in the simulation: 34 from each of the 2 arcs, and 2 from each of the two cluster regions.[1] The bending field and the nonlinear multipole errors were increased correspondingly for the remaining dipoles and were assigned to be zero for the removed dipoles. Thus the reference orbit was changed accordingly. The zeroth order errors (due to random misalignment) and the first order errors were kept the same for both the remaining and the removed dipoles. The corrector strengths were left unchanged except for those used for fine tuning and chromaticity fitting. These steps allow us to isolate the effect due to the missing dipoles by keeping the new lattice identical in other respects to the original lattice.

2.0 FINDINGS

We find that the closed orbit (relative to the corresponding reference orbit) and the beta functions are virtually unchanged throughout the ring. The horizontal dispersion function is perturbed in the manner expected.

Particles were tracked over 50,000 turns for both the original lattice and the new lattice (with 72 short dipoles removed). The survival plots are shown in Figure 1. The dynamic apertures in both cases are quite close.

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[1] E. Courant and A. Garren, private communication.

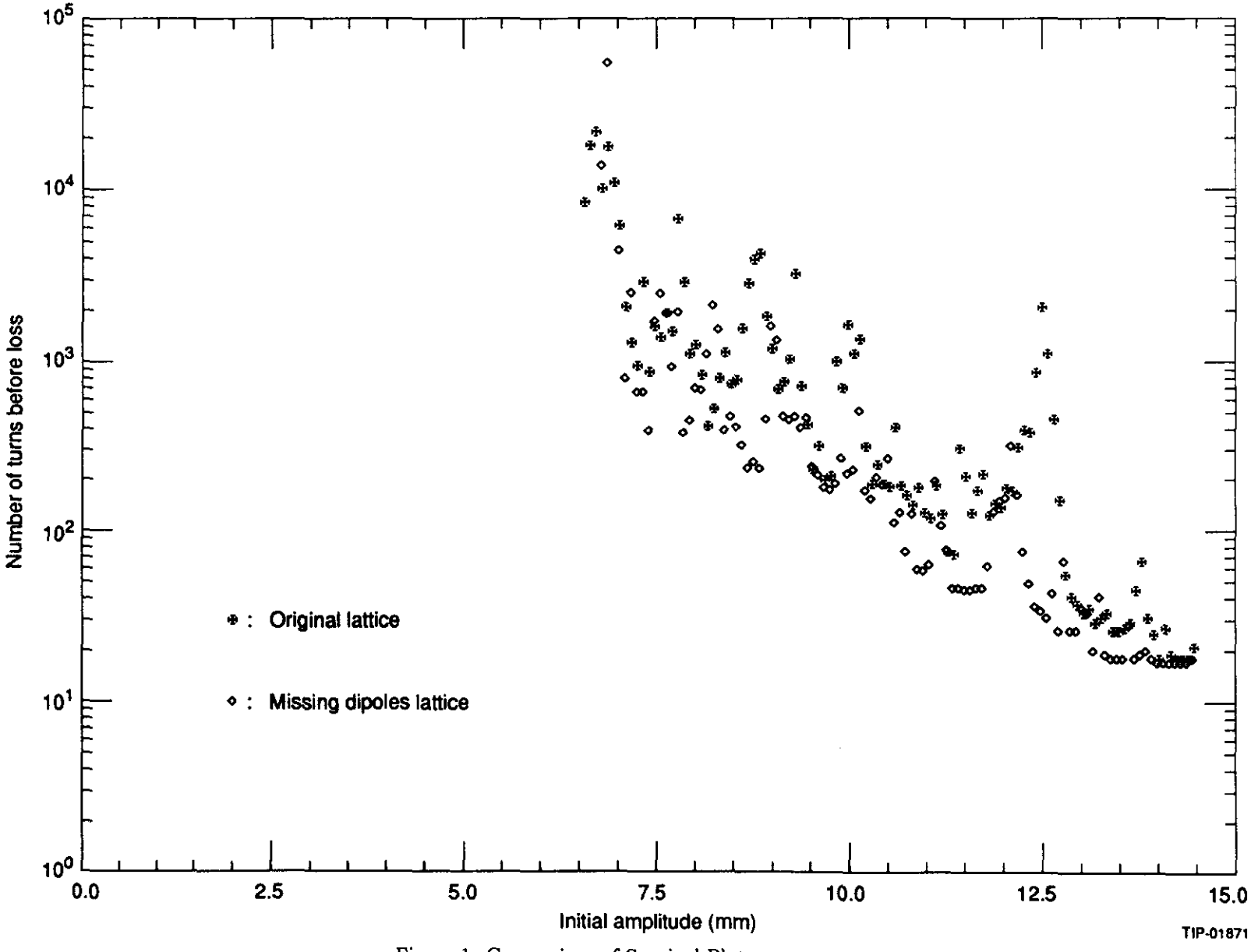

Figure 1. Comparison of Survival Plots.