RHIC Dynamic Aperture for Lattices With Some ß* = 3 Insertions

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1. Introduction

This note points out that it is possible to operate RHIC at $\gamma = 30$ with some insertions having $\beta^* = 3$, and still have enough dynamic aperture to allow the beam to grow because of intrabeam scattering. At the $\beta^* = 3$ insertions the luminosity is higher by a factor of 2.

Tracking studies show that starting with a lattice that has six $\beta^* = 6$ insertions, the dynamic aperture decreases as one introduces $\beta^* = 3$ insertions, and the decrease is roughly monotonic with the number of $\beta^* = 3$ insertions. The results show that RHIC can operate with a beam of gold iions at $\gamma = 30$ for ten hours with up to three $\beta^* = 3$ insertions.

2. Tracking Results

Figure 1 plots the stability limit, A_{SL} or dynamic aperture found as the number of $\beta^* = 3$ insertions is increased from 0 to 6. Note that $\beta^* = 6$ at the insertions where $\beta^* \neq 3$. The tracking runs start with $\varepsilon_x = \varepsilon_y$, and the A_{SL} plotted is the lowest A_{SL} found for 10 different sets of random field errors at $\Delta p/p = 0$.

Figure 2 adds the dynamic aperture, A_{SL}, required by the intrabeam scattering for a beam of gold ions with $N_b = 1.1 \times 10^9$ ions/bunch at $\gamma = 30$, for ions that start out with $\varepsilon_x = \varepsilon_y$.

One sees from Figure 2, that one can have up to three $\beta^* = 3$ insertions for a beam of gold ions at $\gamma = 30$.

Figure 1 also seems to indicate that the periodicity of the $\beta^* = 3$ insertions does not seem to play a large role. The lattice with three $\beta^* = 3$ insertions has a periodicity = 3, the lattice with six $\beta^* = 3$ insertions has a periodicity = 6, and the lattice with one $\beta^* = 3$ and five $\beta^* = 3$ insertions have a periodicty = 1. The result in Figure 1 seems to indicate a roughly monotonic dependence of A_{SL} on the number of $\beta^* = 3$ insertions with little dependence on the periodicity of the insertions.

I am much indebted to S.Y. Lee for providing the input data for the various lattices that were studied.
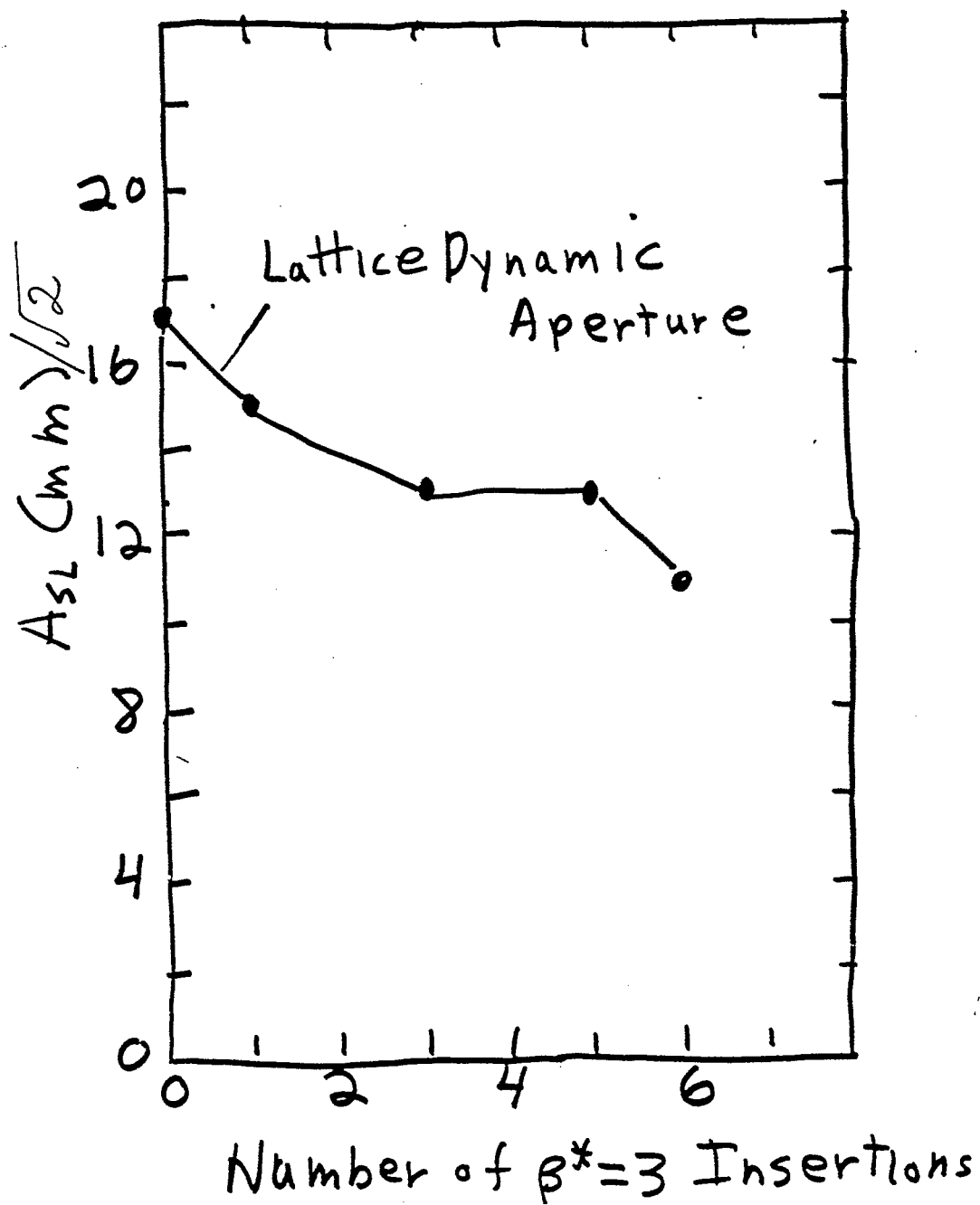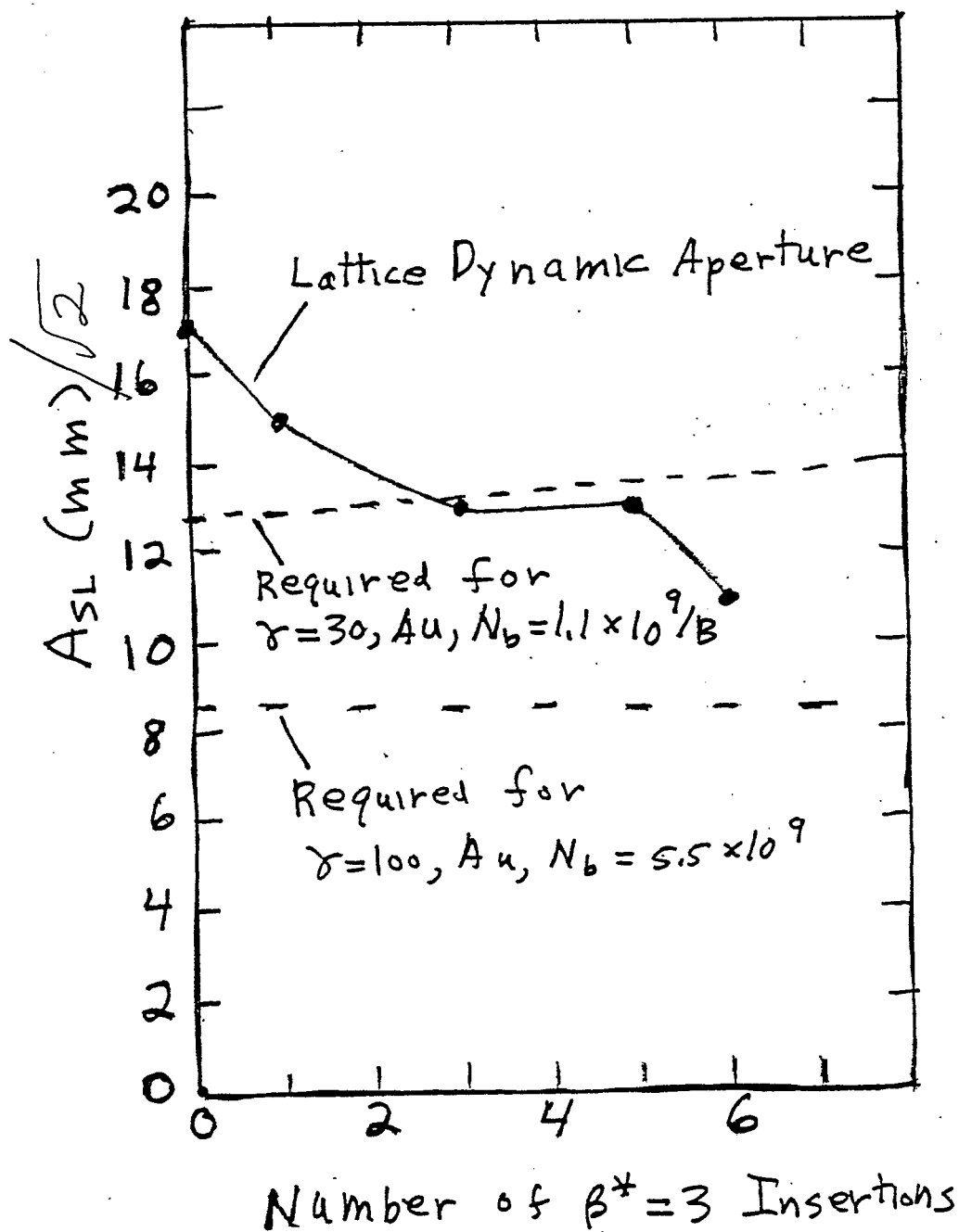
Fig. 1.

Fig. 2