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Split tune operation of a hybrid booster lattice ?x = 3.820, ?y = 4.830

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SPLIT TUNE OPERATION OF A HYBRID BOOSTER LATTICE

$$\mathcal{D}_{x}^{\prime} = 3.820, \mathcal{D}_{y} = 4.830$$

## Booster Technical Note No. 40

G.F. Dell and S.Y. Lee June 5, 1986

ACCELERATOR DEVELOPMENT DEPARTMENT Brookhaven National Laboratory Upton, N.Y. 11973 SPLIT TUNE OPERATION OF A HYBRID BOOSTER LATTICE

$$\mathcal{V}_x$$
 = 3.820,  $\mathcal{V}_y$  = 4.830  
G.F. Dell and S.Y. Lee

Abstract

A comparison is made between operating the hybrid Booster lattice at  $\mathcal{V}_x$  = 3.830,  $\mathcal{V}_y$  = 3.820 and  $\mathcal{V}_x$  = 3.820,  $\mathcal{V}_y$  = 4.830. The coupling reported previously at  $\mathcal{V}_x$  = 3.830,  $\mathcal{V}_y$  = 3.820 is considerably reduced, but indications of effects from the 3rd order structure resonance are still apparent in the horizontal motion.

1. Tracking results for a hybrid Booster lattice<sup>1</sup> operating at  $\mathcal{V}_x$  = 3.830,  $\mathcal{V}_y$  = 3.820 show pronounced coupling and indications of the 3rd order structure resonance.<sup>2</sup>

2. Tracking of the standard combined function Booster lattice<sup>3</sup> shows reduced coupling when the horizontal and vertical tunes are split by one unit.<sup>4</sup> In this note the effects of splitting the tune of the hybrid lattice are reported. Tune selection is based on  $\mathcal{D}_{\mathbf{x}} = 3.820$  being particularly favorable for injection.

Tracking results including the effects of injection eddy current multipoles<sup>5</sup> are shown in Fig. 1 for  $\triangle P/P = 0.0$ %. In Fig. 1(a) appear the previously reported results for  $\mathcal{V}_x = 3.830$ ,  $\mathcal{V}_y = 3.820$ , and in Fig. 1(b) are the results obtained at  $\mathcal{V}_x = 3.82$ ,  $\mathcal{V}_y = 4.830$ . Coupling has been reduced; the phase plot for the vertical motion showsAsign of a resonance, while the phase plot for the horizontal motion is still distorted by the 3rd order structure resonance. While improved by splitting the tune,  $\mathcal{V}_x = 3.820$  may still be too close to the structure resonance at  $\mathcal{V}_y = 4.00$ .

## References

- 1. J. Claus and S.Y. Lee, private communication.
- 2. G.F. Dell, Booster Tech Note #37.
- 3. E. Courant and Z. Parsa, Booster Tech Note #1.
- 4. G.F. Dell, Booster Tech Note #39.
- 5. G. Morgan and S. Kahn, Booster Tech Note # 4.



Fig. 1(a) Hybrid lattice,  $\mathcal{V}_x = 3.830$ ,  $\mathcal{V}_y = 3.820$ , With eddy current multipoles.  $\Delta P/P = 0.0$ %, Chromaticity = 0.0 in both planes,  $\mathbf{E}_x = \mathbf{E}_y = 50$  mm mrad.



Fig. 1(b) Hybrid lattice,  $\mathcal{V}_x = 3.820$ ,  $\mathcal{V}_y = 4.830$ , With eddy current multipoles.  $\Delta P/P = 0.0$ %, Chromaticity = 0.0 in both planes,  $\boldsymbol{\ell}_x = \boldsymbol{\ell}_y = 50 \pi$  mm mrad.