



BNL-105087-2014-TECH

Booster Technical Note No. 40;BNL-105087-2014-IR

Split tune operation of a hybrid booster lattice  $\nu_x = 3.820$ ,  $\nu_y = 4.830$

G. F. Dell

June 1986

Collider Accelerator Department  
**Brookhaven National Laboratory**

**U.S. Department of Energy**

USDOE Office of Science (SC)

Notice: This technical note has been authored by employees of Brookhaven Science Associates, LLC under Contract No. DE-AC02-76CH00016 with the U.S. Department of Energy. The publisher by accepting the technical note for publication acknowledges that the United States Government retains a non-exclusive, paid-up, irrevocable, world-wide license to publish or reproduce the published form of this technical note, or allow others to do so, for United States Government purposes.

## **DISCLAIMER**

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

SPLIT TUNE OPERATION OF A HYBRID BOOSTER LATTICE

$$\mathcal{V}_x = 3.820, \mathcal{V}_y = 4.830$$

*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

$$\nu_x = 3.820, \nu_y = 4.830$$

G.F. Dell and S.Y. Lee

### Abstract

A comparison is made between operating the hybrid Booster lattice at  $\nu_x = 3.830, \nu_y = 3.820$  and  $\nu_x = 3.820, \nu_y = 4.830$ . The coupling reported previously at  $\nu_x = 3.830, \nu_y = 3.820$  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  $\nu_x = 3.830, \nu_y = 3.820$  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  $\nu_x = 3.820$  being particularly favorable for injection.

Tracking results including the effects of injection eddy current multipoles<sup>5</sup> are shown in Fig. 1 for  $\Delta P/P = 0.0\%$ . In Fig. 1(a) appear the previously reported results for  $\nu_x = 3.830, \nu_y = 3.820$ , and in Fig. 1(b) are the results obtained at  $\nu_x = 3.82, \nu_y = 4.830$ . Coupling has been reduced; the phase plot for the vertical motion shows a sign 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,  $\nu_x = 3.820$  may still be too close to the structure resonance at  $\nu_x = 4.00$ .

### 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.

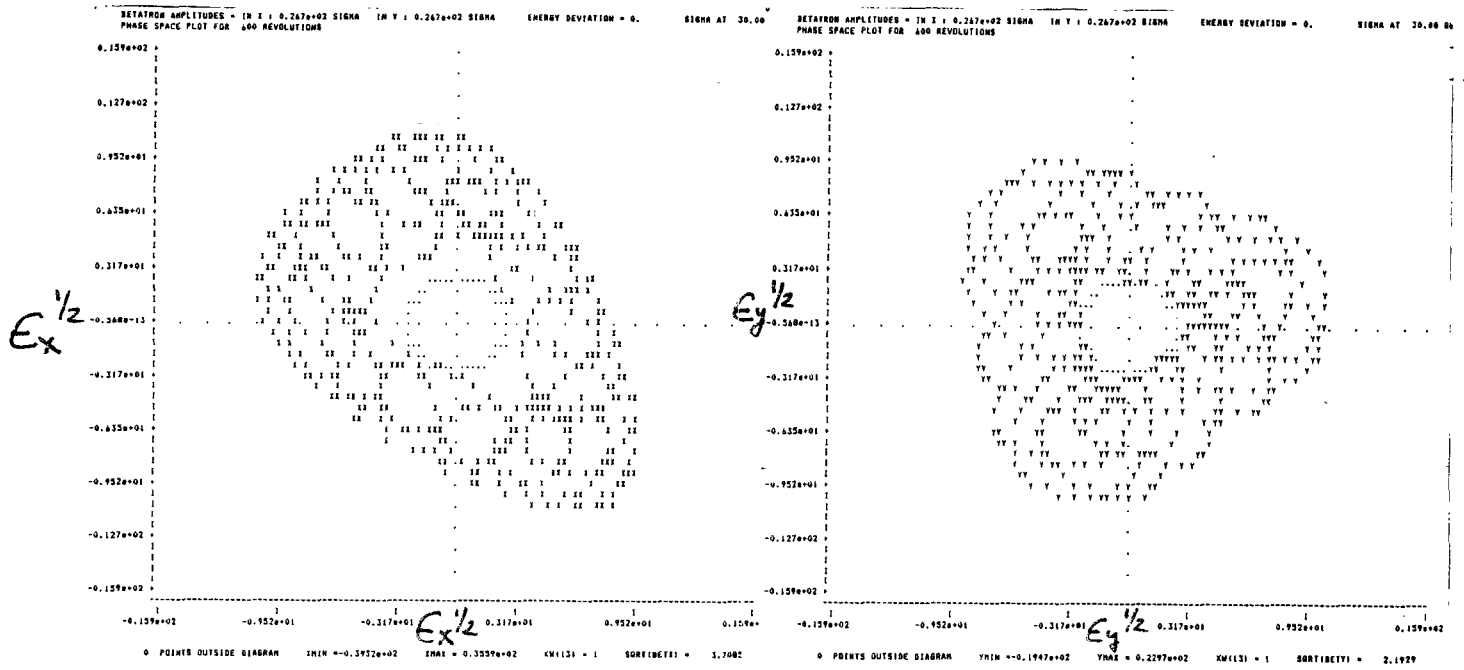


Fig. 1(a) Hybrid lattice,  $\nu_x = 3.830$ ,  $\nu_y = 3.820$ , With eddy current multipoles.  
 $\Delta P/P = 0.0\%$ , Chromaticity = 0.0 in both planes,  $\epsilon_x = \epsilon_y = 50\pi$  mm mrad.

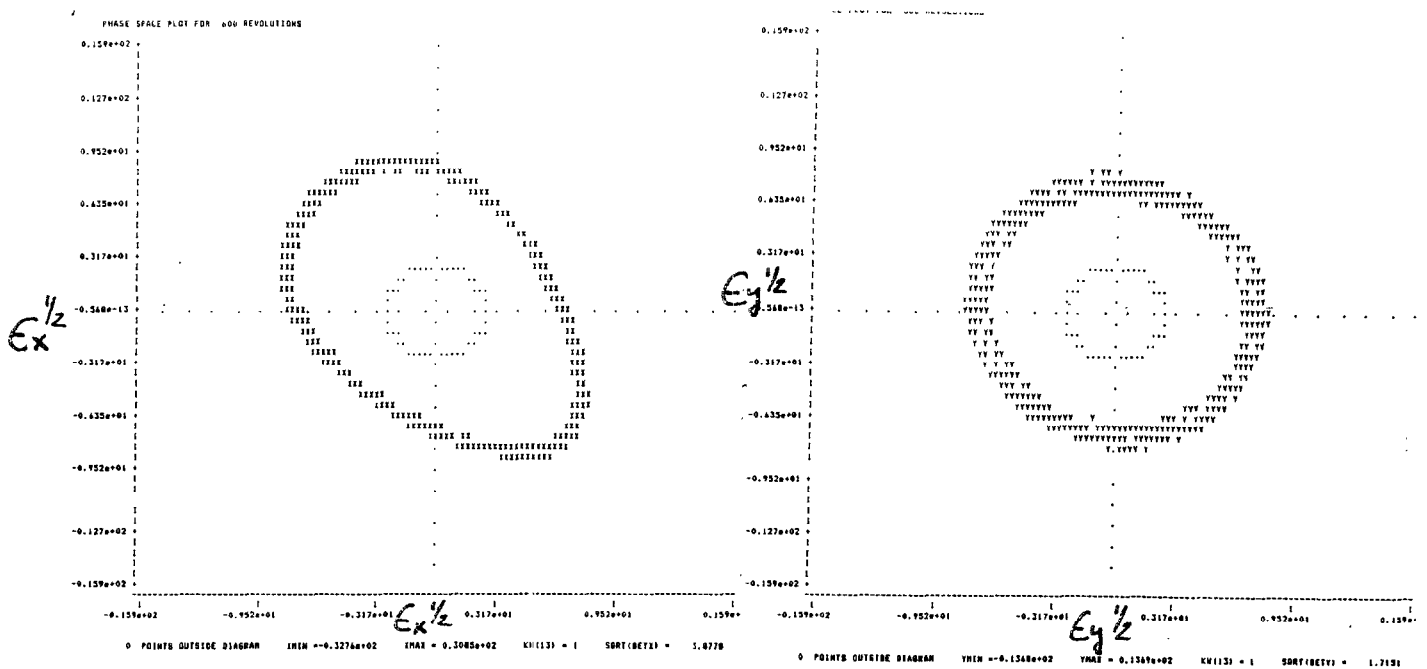


Fig. 1(b) Hybrid lattice,  $\nu_x = 3.820$ ,  $\nu_y = 4.830$ , With eddy current multipoles.  
 $\Delta P/P = 0.0\%$ , Chromaticity = 0.0 in both planes,  $\epsilon_x = \epsilon_y = 50\pi$  mm mrad.