

Non-Scaling Lattices with Chromaticity Correction

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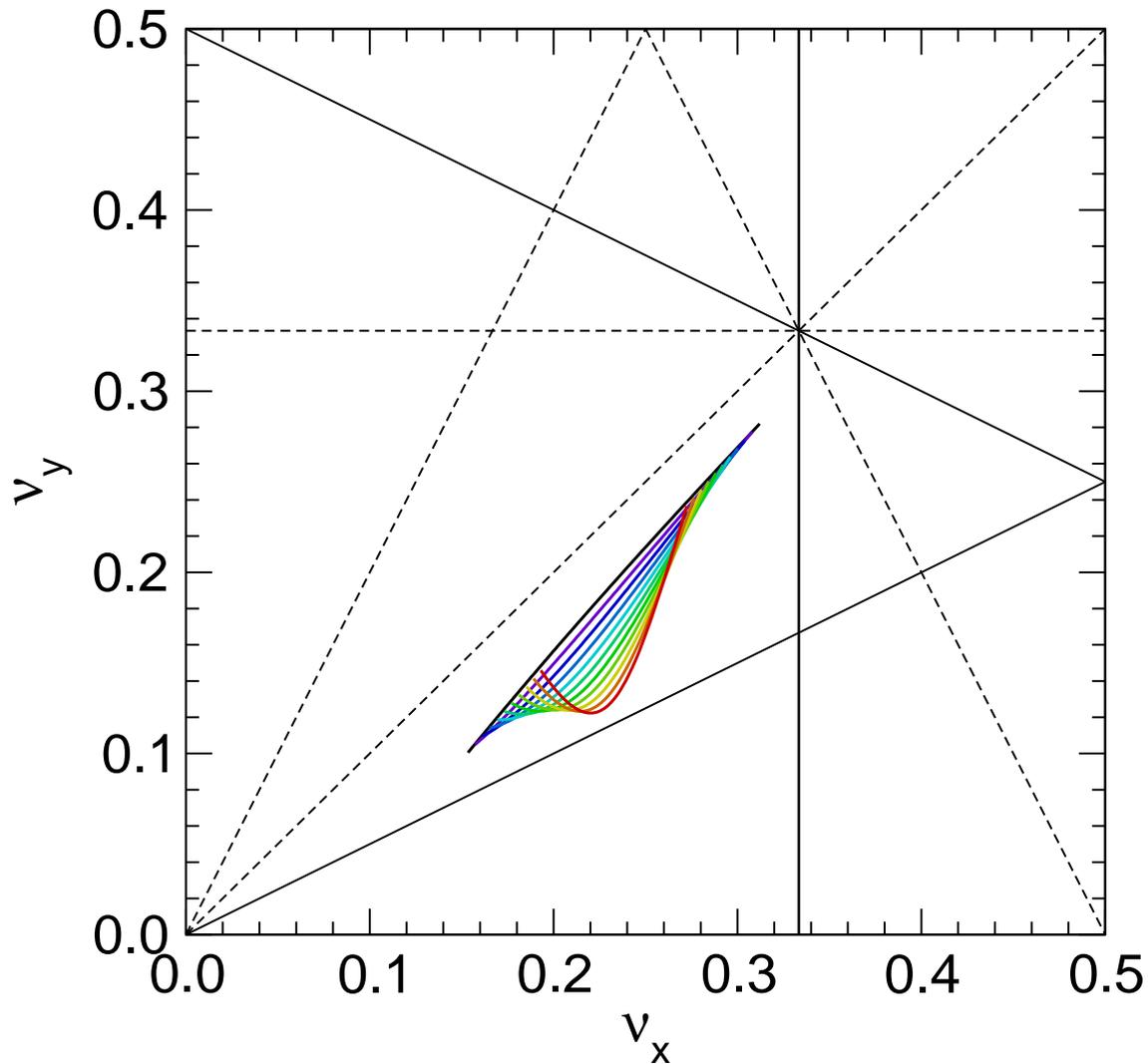
Chromaticity Correction Method

- Chromaticity correction desirable to reduce time of flight variation with transverse amplitude
- Correct chromaticity with a sextupole component to magnets as follows
 - ◆ Construct a linear lattice where
 - ★ Magnet lengths, drift lengths, and the number of cells are fixed
 - ★ Time of flight is the same at low and high energy
 - ★ The following three distances in the tune plane are equal
 - Low energy tune ($\nu_{lo,0}$) to $3\nu_x = 1$ line
 - Low energy tune to $\nu_x - \nu_y = 0$ line
 - High energy tune ($\nu_{hi,0}$) to $\nu_x - 2\nu_y = 0$ line

Chromaticity Correction Method

- Chromaticity correction procedure (cont.)
 - ◆ Add sextupole components, and modify dipole and gradient components so that
 - ★ Magnet lengths, drift lengths, and the number of cells are fixed
 - ★ Time of flight is the same at low and high energy
 - ★ If x is the fraction of chromatic correction
 - > $\nu_{lo} = (1 - x)\nu_{lo,0} + x\nu_{hi,0}$
 - > $\nu_{hi} = x\nu_{lo,0} + (1 - x)\nu_{hi,0}$
- Choice of tune range to avoid third order resonances which sextupole will drive
- Plot shows to $x = 0.5$

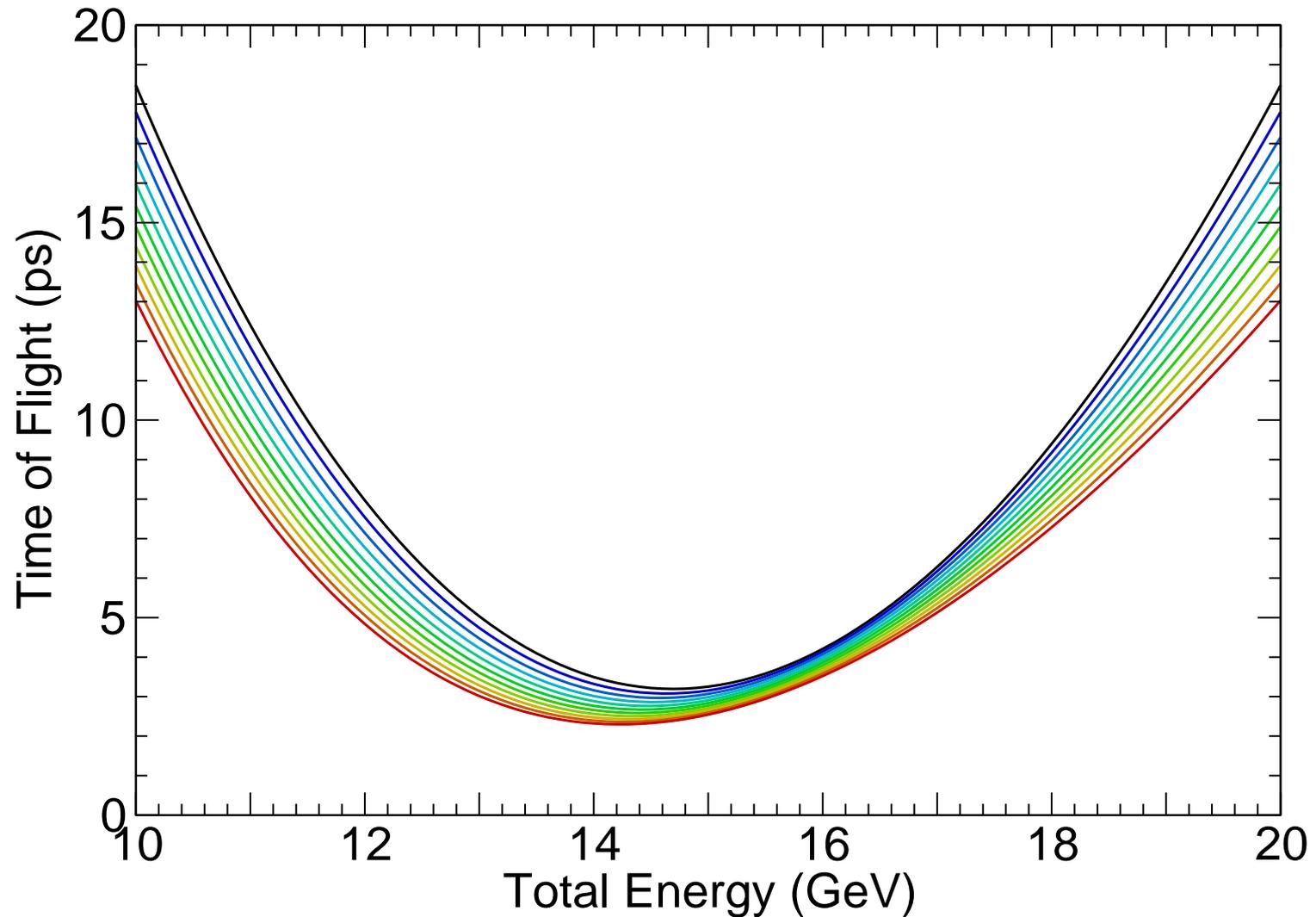
Tune Range with Chromaticity Correction



Observations

- Note chromaticity is locally higher!
- However, for uniform acceleration, what matters is the total change in tune
 - ◆ However, increased chromaticity may affect phase space locally!
- Time of flight range actually improves with more sextupoles
- Must determine if dynamic aperture is sufficient
 - ◆ Losses likely on $4\nu_x = 1$ resonance
 - ◆ Should ascertain if we have decent dynamic aperture except for that
- Full chromaticity correction (to $x = 1$)
 - ◆ Still have significant actual chromaticity
 - ◆ Could add octupole to reduce the range, if there is any dynamic aperture in the first place

Time of Flight Variation with Chromaticity Correction



Tune Range with Full Chromaticity Correction

