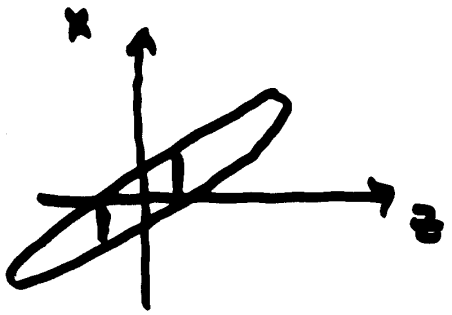
- Possible improvements in 1D

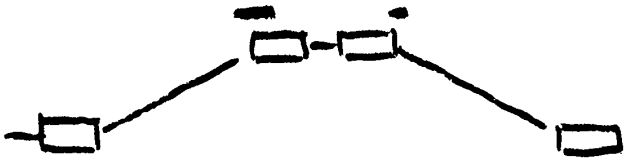
  1. Transient wake in a system of many magnets or general small-angle orbit

  2. Potential term $\left(\frac{d\phi}{dt}\right)$ in transient wake can be partially cancelled by $F_\perp$.

  3. Correction to 1D at small distances due to finite σ_x.

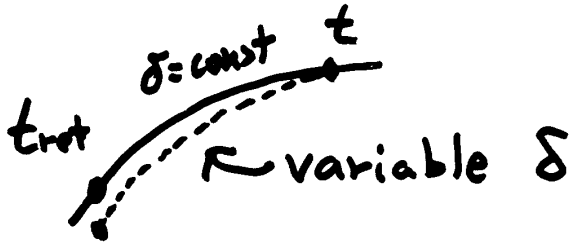


- How accurately 1D CSR wake takes into account variation of the bunch distribution function during bunch compression?



If the energy change due to CSR is negligible then retardation effects are taken into account correctly in single particle (Green's function) calculation

If the energy variation is essential (as in CSR instability) then 1D model makes an error



- Correct account of longitudinal motion in CSR instability

We used in our model

$$\Delta z = R_{56}(s)\,\delta \Rightarrow \frac{d\Delta z}{ds} = R'_{56}\,\delta$$

The correct approach → $R_{56}(s',s)$, $\delta(s)$

$$\Delta z(s) = \int_0^s ds' \frac{d\delta}{ds'} R_{56}(s',s)$$

$$\frac{d\Delta z}{ds} = \int_0^s ds' \frac{d\delta}{ds'} R'_{56}(s',s)$$

This approach cannot be implemented in Vlasov eq. Need to use transverse coord.

$$f(s,z,\delta,x,\theta)$$

$$\frac{\partial f}{\partial s} + \frac{x}{R}\frac{\partial f}{\partial z} + \theta\frac{\partial f}{\partial x} + \left(-\frac{1}{R^2} + \frac{\delta}{R}\right)\frac{\partial f}{\partial \theta} +$$

$$\frac{\partial f}{\partial \delta}\int W(z-z',s)\, f\, dz'\, d\theta\, dx\, d\delta = 0$$