PHY 554. Homework 1.

Handed: September 10,2018 Return by: September 17, 2018
Electronic copies accepted at yjing@bnl.gov

HW 1 (4 pts). Magnet kicker (dipole)

Using the transfer matrix **M** to show that, when a particle is kicked at *s1* by angle θ, the displacement at a downstream location *s2* is

$$\Delta x_2 = \theta\sqrt{\beta_1\beta_2}sin\mu,$$

Where β_1 and β_2 are values of betatron functions at *s1* and *s2* respectively, and μ is the betatron phase advance between *s1* and *s2*. The quantity $\sqrt{\beta_1\beta_2}sin\mu$ is usually called the kicking arm. In the scenario of designing a magnet kicker (which kicks the beam for injection/extraction or other orbit change), to obtain the maximum kick (or minimum kicker strength), what are the requirements for choosing the kicker location?

HW 2 (6 pts). FODO cells

An accelerator is made of 12 FODO cells with circumference of 180 m. The betatron tunes (phase advance per revolution divided by 2π) Qx/Qy are 3.5/3.4 respectively. What are the maximum/minimum betatron functions (x and y) and where are they located at?

Given the RMS beam emittance ε is 1 mm-mrad, what is the minimum vacuum chamber size to house such beam without losing particles.