

Lecture 2: Problems

1. Given a normalised vertical emittance of 0.01 m for the positron beam injected into a damping ring, an equilibrium normalised emittance of 15 nm, and a store time of 200 ms, calculate the damping time required to achieve an extracted beam normalised emittance of 20 nm.
2. For this question, assume a damping ring circumference of 3 km, *or* 6 km *or* 17 km. In the case of a 17 km circumference, assume that the damping rings have a “dogbone” layout, with two arcs (total bending 4π radians) separated by long straights. Assume that the beam has an energy of 5 GeV.
 - a) Calculate the dipole field needed to provide the damping time calculated in question (1), if there is no wiggler in the damping ring.
 - b) Calculate the natural energy spread for the dipole parameters calculated in part (a).
 - c) Assuming a momentum compaction factor of 4×10^{-4} and an RF frequency of 650 MHz, calculate the RF voltage needed to provide a natural bunch length of 9 mm.