

Homework 6 (due Mar 18)

In the Tevatron, protons and antiprotons are accelerated from a kinetic energy of 150 GeV to 980 GeV in 60 s. Its circumference is $L = 6.28$ km, and its transition energy corresponds to $\gamma_t = 18.7$. The radiofrequency cavities operate at 53.1 MHz. The maximum energy they can provide is $qV = 1.4$ MeV per revolution.

- (a) Calculate the synchronous phase ϕ_s .
- (b) For both the injection energy and the maximum energy, calculate the synchrotron tune ν_s and the synchrotron frequency f_s . For small oscillation amplitudes, how many revolutions are necessary to complete a synchrotron oscillation?
- (c) What is the area \mathcal{A} of the stationary bucket at maximum energy?