

Longitudinal Dynamics Homework.



- The Advanced Light Source is an electron storage ring for producing synchrotron radiation. From the parameters shown, calculate the values below
 - Orbit circumference?
 - Synchronous phase angle
 - Synchrotron frequency?
 - Synchrotron tune?
 - RMS Bunch length?
 - Value of RF voltage to give 3 mm bunch length

ALS Parameters

- $F_{rf}=499.654$ MHz
- $h=328$
- $E=1.9$ GeV
- $V_{rf}=1.2$ MV
- $U_0=150$ kV
- $\text{Alpha}=1.6e-3$

Cavity Homework #2



- The storage ring bunch length is given by

$$\sigma_{\Delta S} = \frac{c\eta_C}{\Omega} \frac{\sigma_p}{p_0} = \sqrt{\frac{c^3}{2\pi q} \frac{p_0\beta_0\eta_C}{h f_0^2 \hat{V} \cos(\phi_S)}} \frac{\sigma_p}{p_0}$$

- Describe at least four approaches to reduce the bunch length. Discuss the pros/cons of each of these approaches.

Extra Credit Longitudinal Homework



- Magnetic bunch compressors are used in linacs to rotate the longitudinal phase space.
 - Draw a cartoon view of the longitudinal phase at each stage of the compressor.
 - Because the chirp provided by the RF waveform is sinusoidal, it provides some curvature to the energy distribution of the beam. Represent the effect of this curvature in a phase space diagram and describe how it effects the bunch compression.