

PHY 554. Homework 4.

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HW 1 (5 points): A multi-cell accelerating RF linac operating at 500 MHz in a standing wave π -mode (e.g., each cell has opposite sign of the accelerating voltage from the neighboring cell) is used to accelerate non-relativistic heavy ion ($Z=2$, $A=79$) moving with velocity $v=c/3$ ($\beta=1/3$).

- (a) find the length of the cell required for resonant acceleration in such a linac. 2 points.
- (b) at what velocity (ies) (and energy(ies) of the ion), the energy gain in 5-cell cavity would vanish (became zero). 3 points.

HW 2 (5 points): A $l=0.3$ m long 500 MHz pillbox cavity operates in fundamental accelerating TM_{010} mode with peak accelerating electric field of 20 MV/m.

- (a) Find the energy stored in electric and magnetic fields as function of time. 2 points.
- (b) What is the total energy of EM field in the cavity? Does it change with time? 1 point.
- (c) What will be losses of the energy for Q-factor of 30,000? 2 points