

# Travelling wave structure design

- Simulate 1 full wavelength (or similar) synchronized with particle standing wave structure
- Corresponding eigenmode is a sum of two travelling modes of interest.
- Due to additivity, stored energy of SW solution is a sum of stored energy in TW as well as power dissipation  $P_{SW} = 2 P_{TW}$
- Quality factor stays the same:

$$Q = \frac{U_{SW}}{P_{SW}} = \frac{2U_{TW}}{2P_{TW}}$$

- Amplitude of the standing wave composed out of two travelling waves with amplitudes  $E_0$  is  $2E_0$  (easy to show)
- In accelerating structures this is compensated by the transit factor, T: in TW structure particle always sees maximum field ( $T=1$ ), while in SW it will see an average field, which is typically half of a maximum ( $T=0.5$ ) To be sure Transit factor can be calculated from simulation.
- Shunt impedance of travelling structure is two times larger then of simulated standing wave:

$$R_{shunt_{SW}} = \frac{(T \cdot E_{SW} \cdot d)^2}{P_{SW}} = \frac{(0.5 \cdot 2 \cdot E_{TW} \cdot d)^2}{2P_{TW}} = 0.5 R_{shunt_{TW}}$$