

1) Design a bunch compressor for an electron beam with the following characteristics:

- $W_{in} = 300 \text{ MeV}; W_{out} = 1.2 \text{ GeV}$
- $chicane R_{56} = -40 \text{ mm}$
- $compressor factor = 4$
- $f_{RF} = 1300 \text{ MHz}$

Calculate V_{RF} , φ_0 , and the approximate length of the linac portion dedicated to the bunch compression assuming @ $E_{acc} = 30 \text{ MV/m}$

2) Considering an observation time of 100 ms (i.e. $f_L = 10 \text{ Hz}$) the arrival time jitter of the bunches entering the compressor is $\sigma_{t_{in}} = 300 \text{ fs}$, while the RF in the compressor shows a SSB phase noise power spectrum of the f^{-2} type with $\mathcal{L}(f = 1 \text{ kHz}) \approx -110 \text{ dB}_c/\text{Hz}$.

Calculate the maximum allowed RF amplitude jitter $\sigma_{(\Delta V_{RF}/V_{RF})|_{max}}$ to limit the bunch arrival time jitter at the compressor output to $\sigma_{t_{out}} = 180 \text{ fs}$.

For the calculation assume all jitter contributions uncorrelated and neglect the intra-bunch energy spread and the bunch-to-bunch energy scatter of the incoming beam.