Study for High Beta Family β_g, and Number of Medium Beta Cryo-modules

- Vary the number of medium beta cryo-modules and high beta β_g to optimize the design

  - Want minimum number of cryo-modules to get 1 GeV at 27.5 MV/m peak surface field
  - Want small phase slip at transition (high TTF at entrance to high beta family)
  - Want minimal peak surface field increase to reach 1.2 GeV

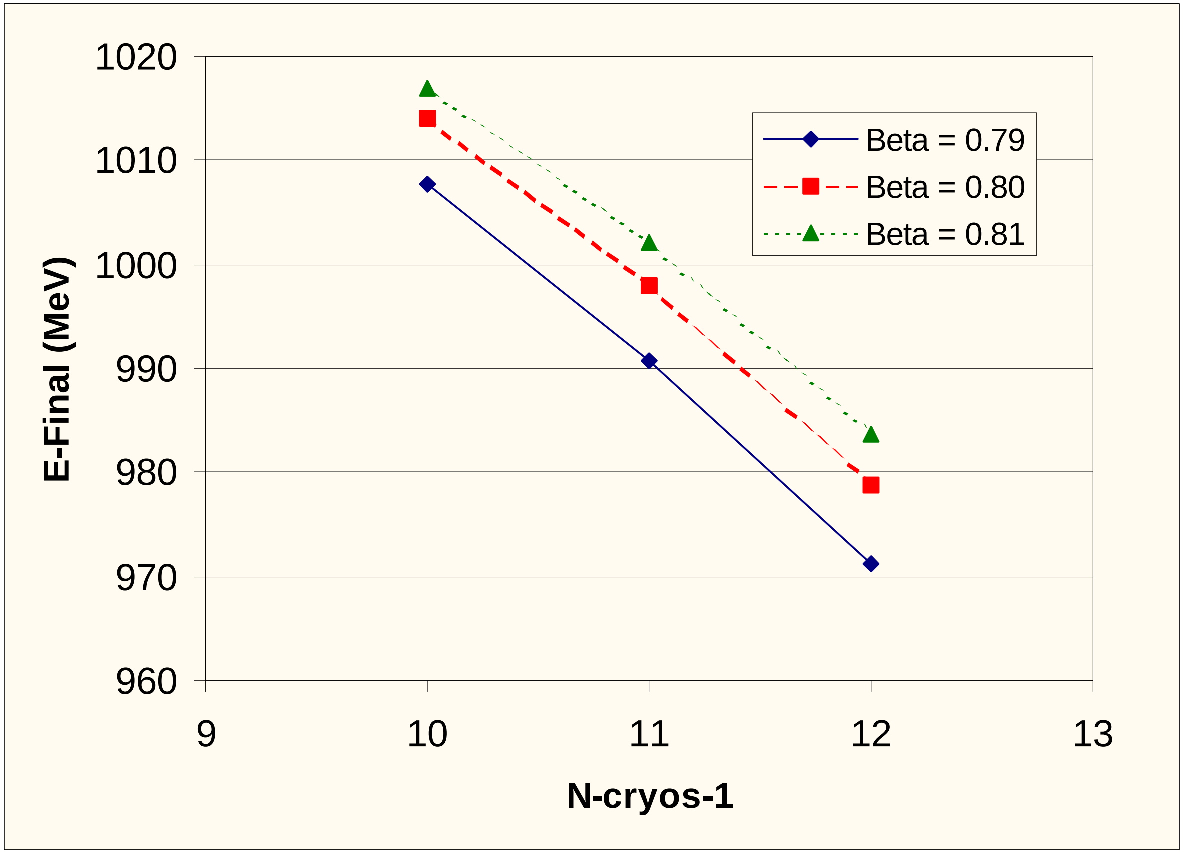
- Phase Ramp:

  - Medium beta family changed to facilitate matching: start at -22^o; match $E_0 T\sin(\phi)$ at the entrance to the high beta section; use two linear ramps, the first over 1/3 of the cryo-modules with twice the slope as the latter ramp
  - High beta family: use 26.5^o as before

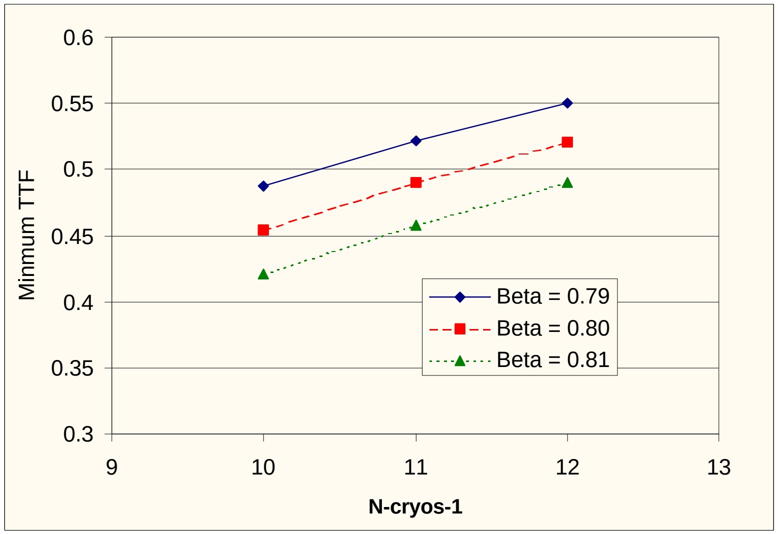
- Use new $\beta_g = 0.61$ cavity E_{peak} / E_0

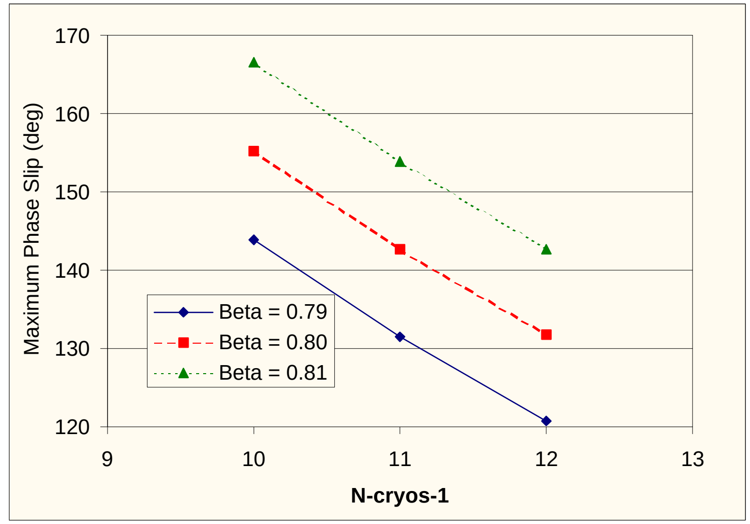
Step 1: Performance at E_{peak} = 27.5 MV/m

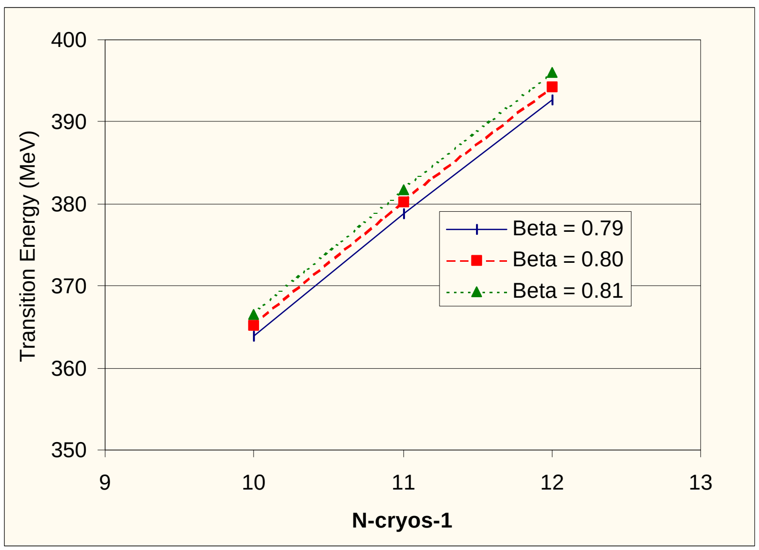
- Keep E_{peak} = 27.5 MV/m
- Keep the total number of cryo-modules = 27 (two fewer than the reference case).
- Look at the attainable final energy for different

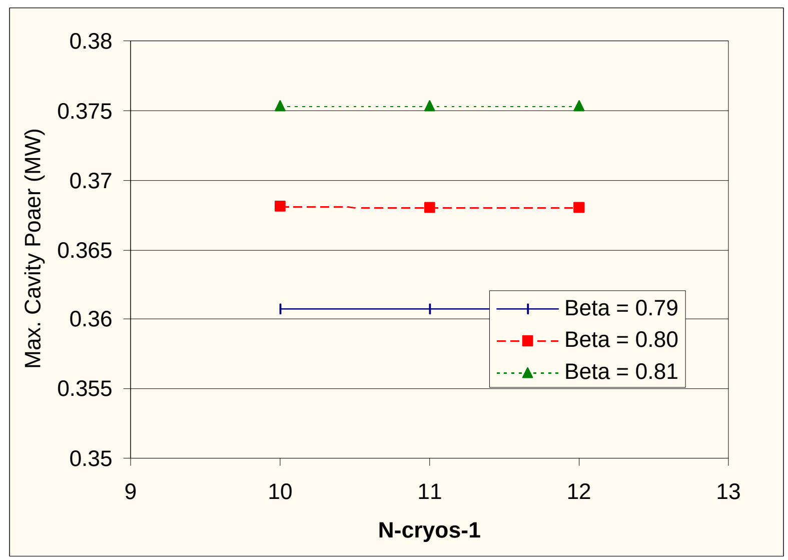


Step 1: Performance at E_{peak} = 27.5 MV/m, con't.



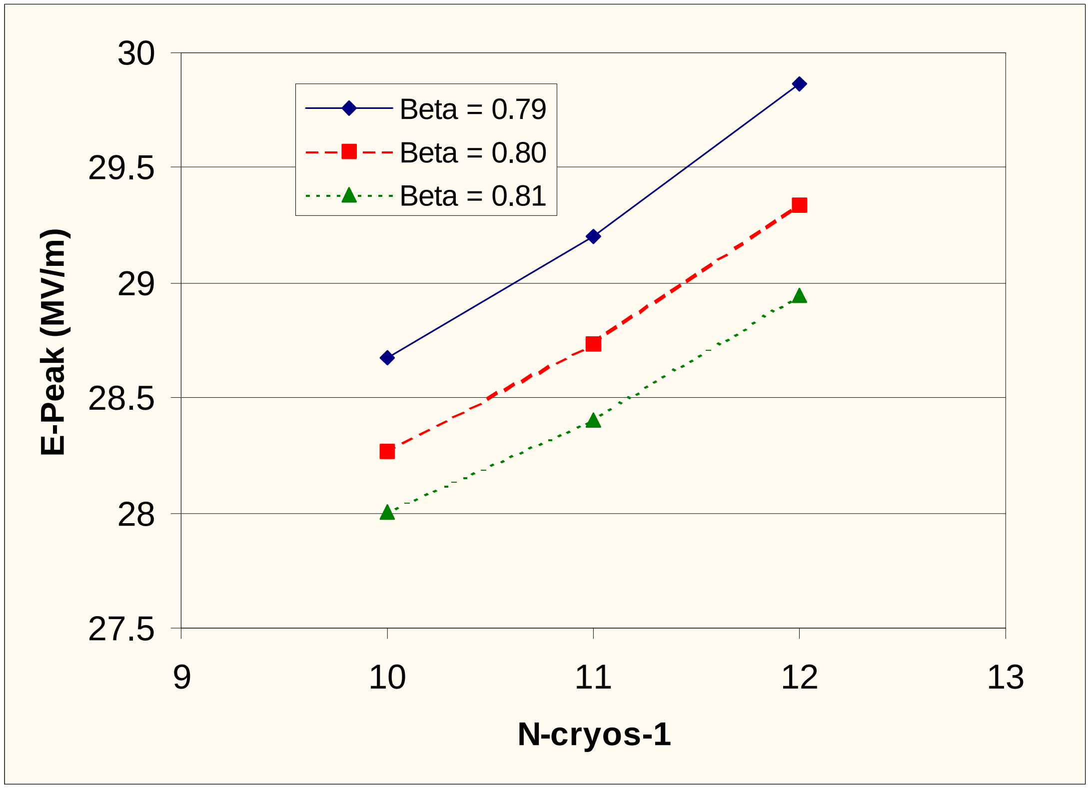




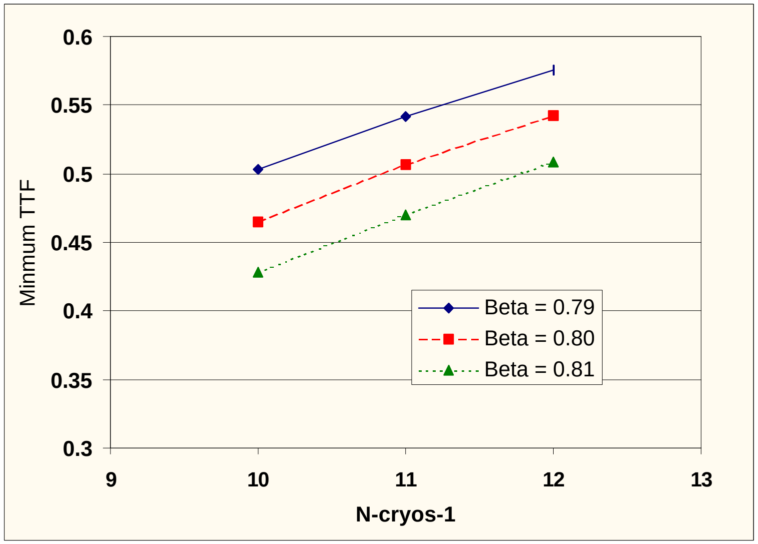


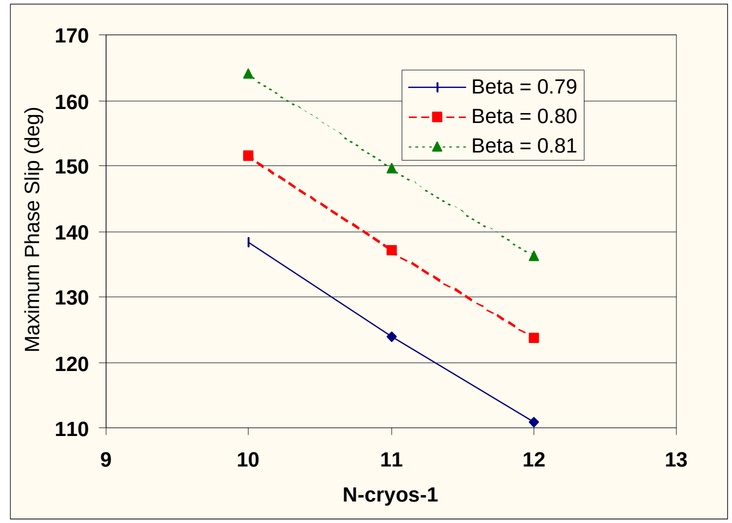
Step 2: 1.2 GeV Capability

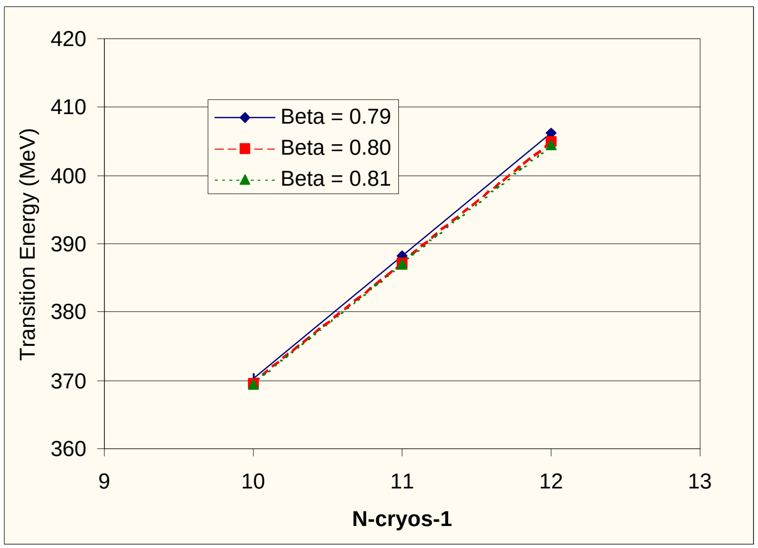
- Keep the total number of cryo-modules = 31 (reference 29 + 2 “empty” slots).
- Calculate the peak field required for 1.2 GeV operation

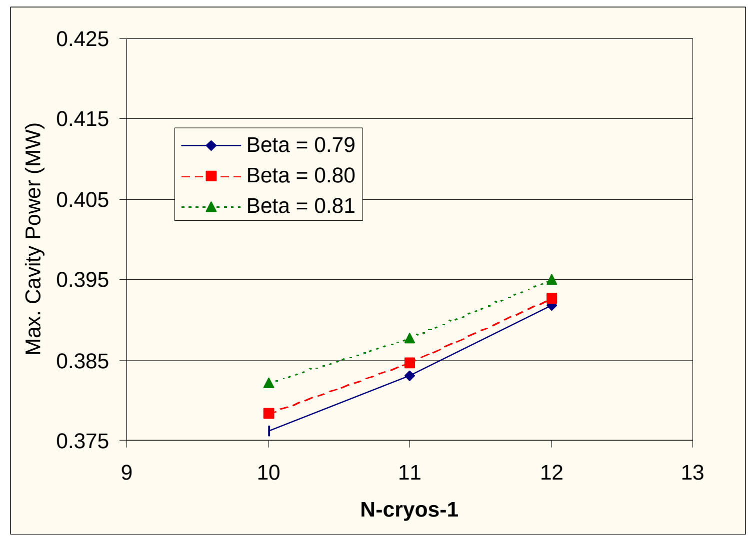


Step 2: 1.2 GeV Capability, con't.









Summary

Fewer medium beta cryo-modules and higher β_g favors synchronous particle acceleration

More medium beta cryo-modules and lower β_g favors smaller phase slips, and higher TTF at the transition

Need 10 or 11 medium beta cryo-modules and β_g = 0.80 or 0.81 to reach > 1 GeV with 27.5 MV/m