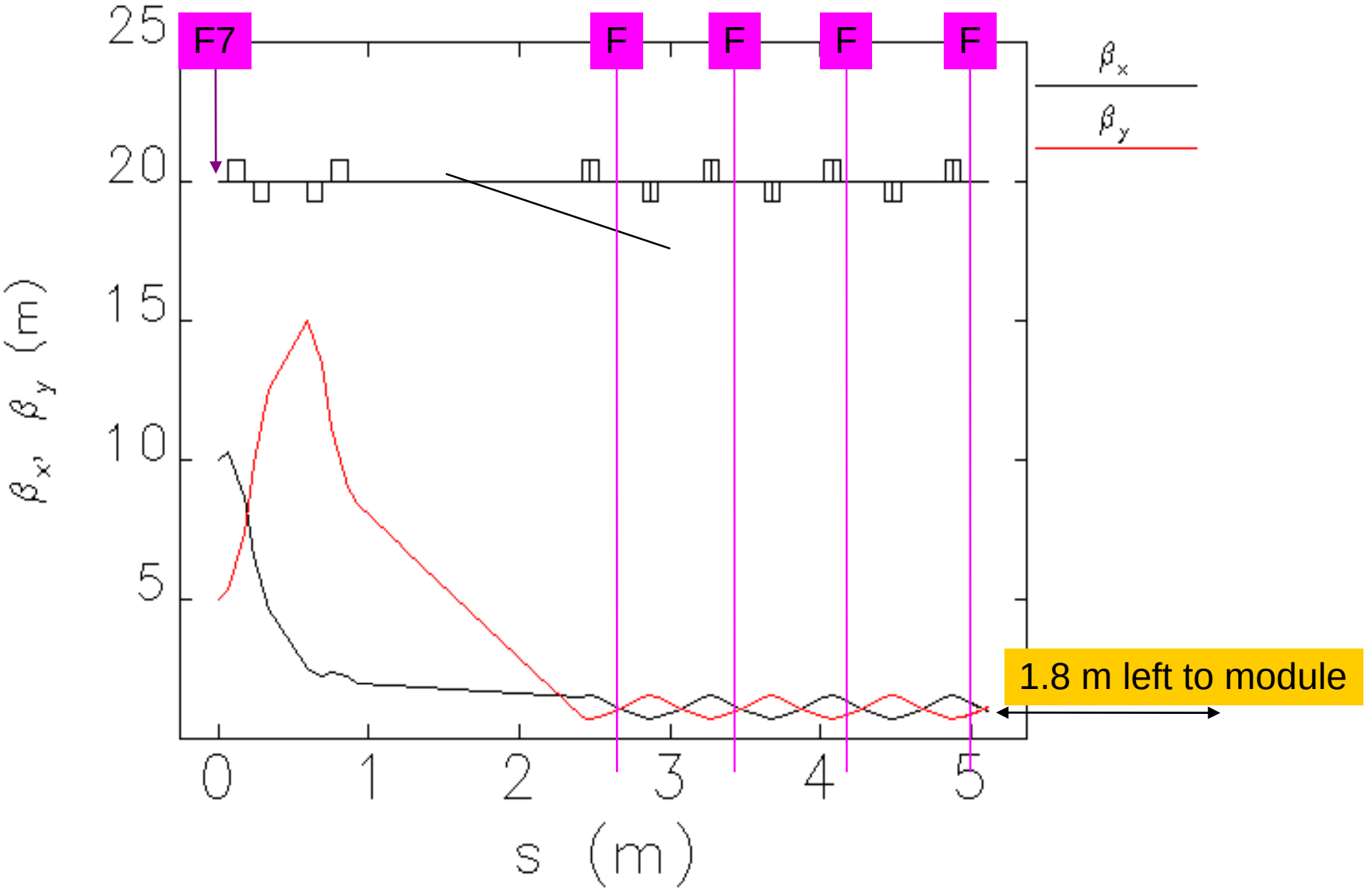
FODO cell (no space charge case): k1 = 20.48 m^-2



1.8 meters left before module, what do we need? 4 quads to “match in the module”, small dogleg to offset the beam (HOM experiment???)

Effect of space charge: FODO cell periodic solution

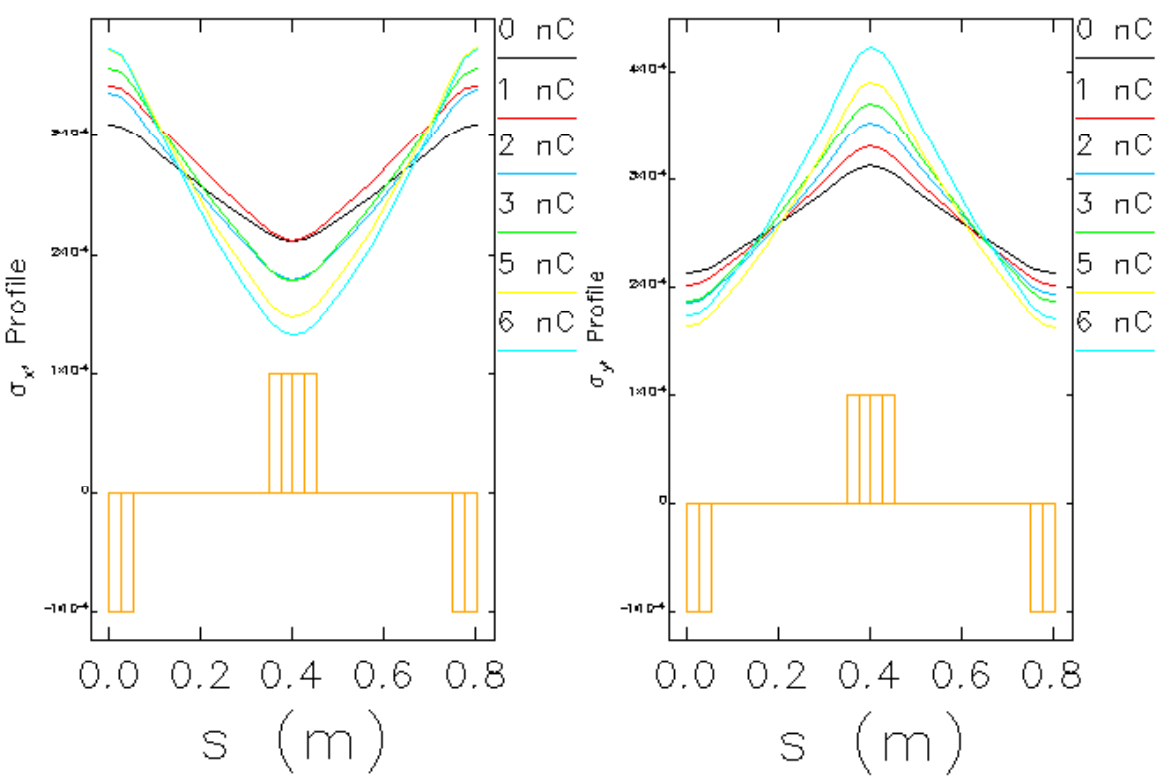
- Developed an iterative method to seek periodic solution, taking into account space charge, in a FODO cell
- For this simple model space charge is model as a thin lens with (defocusing) strength (assume a tri-Gaussian bunch – this is a LINEARIZED space charge kick)

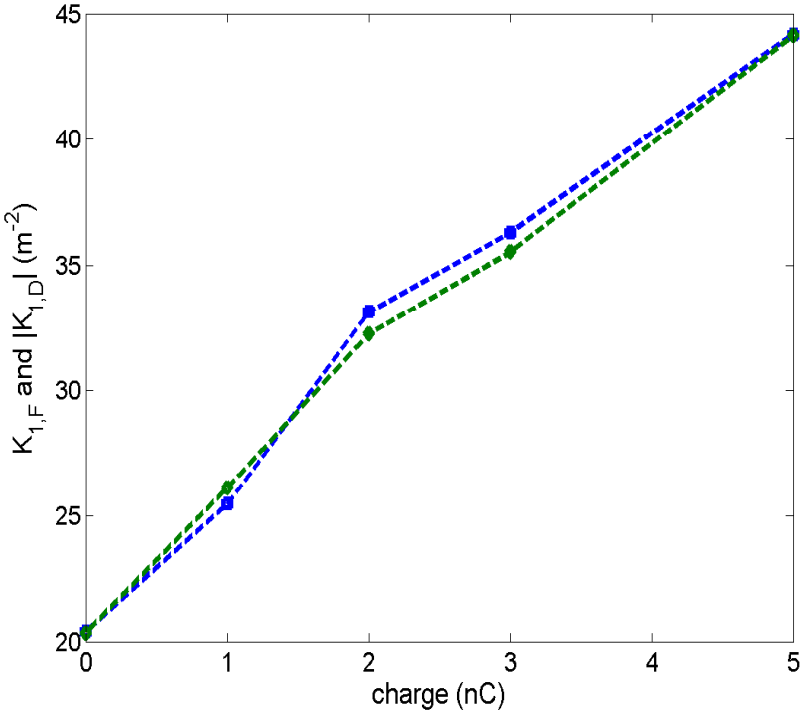
$$\kappa_{x,y} = \frac{2Nr_0L}{\sqrt{2\pi}\gamma^3\sigma_z}\frac{1}{\sigma_{x,y}(\sigma_x+\sigma_y)}$$

- The periodic solution is found iteratively:
  a- 0 nC case is calculated → rms beam size
  b- New envelope computed
  c- Matrix and phase advance evaluated
  d- Charge set to desired value and b c repeated several times

Effect of space charge: FODO cell periodic solution

- Matching harder as charge is increased
- hard to exactly match the two plane with $\pi/4$ / cell,
- Measuring emittance in two planes with good accuracy will (most probably) require two matchings.





FODO cell channel what for???

- FODO channel were proposed in several accelerator to
  - force a good matching at a location in the accelerator,
  - Provide a fast emittance measurement
    (see Woodley and Emma Proc. of LINAC 2000)

  - It might be valuable to ILCTA if we need to measure/monitor emittance on a regular basis before the cryomodule (do we?)

  - Space charge is complicating things, matching: seems (simplex matching at least) not possible in both planes simultaneously and one would have to:
    - Match in one plane
    - Measure in the emittance
    - Match in the other plane
    - Measure the other plane emittance…

- So in this regards there is no much benefits from a FODO channel compared to a quadscan technique…

CSR + SC transverse emittance growth at 1 nC/bunch

- Incoming beam parameter: 2.5 mm-mrad emittance bunch compressed. [min(emit_x) after compression = 6.3 mm-mrad]