One-coil-per-cell solenoid lattices

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MC Friday Meeting

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Solenoid cooling lattices

- collaborating with Bob Palmer on cooling lattice study
- 4 lattices have been used in past NF and MC studies
- systematically examining all symmetry configurations
- examine properties using “engineering” approach

  i.e. examine dependence of properties on things you can change

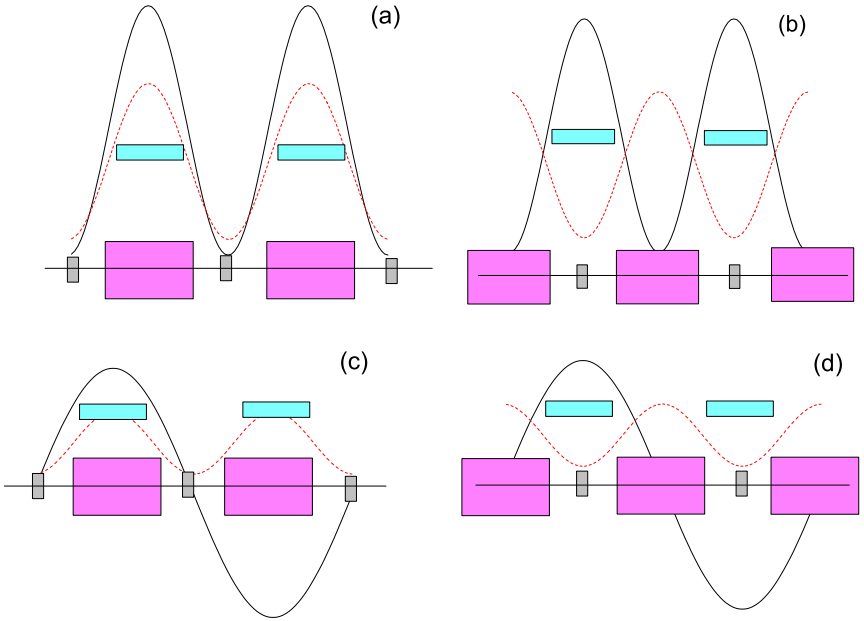
  cell length

  coil dimensions

  current density

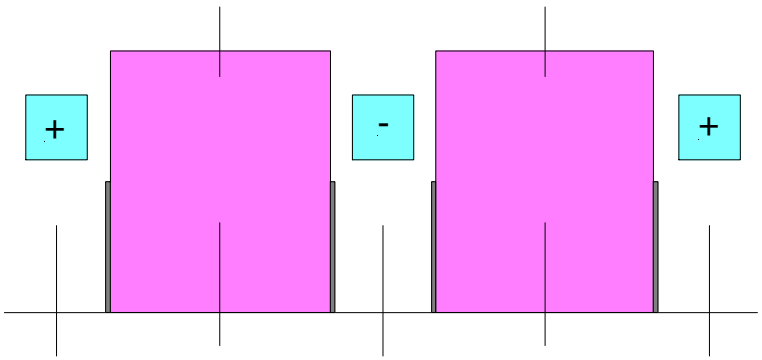
  alternate cell current polarity

One coil cells



4 symmetry classes

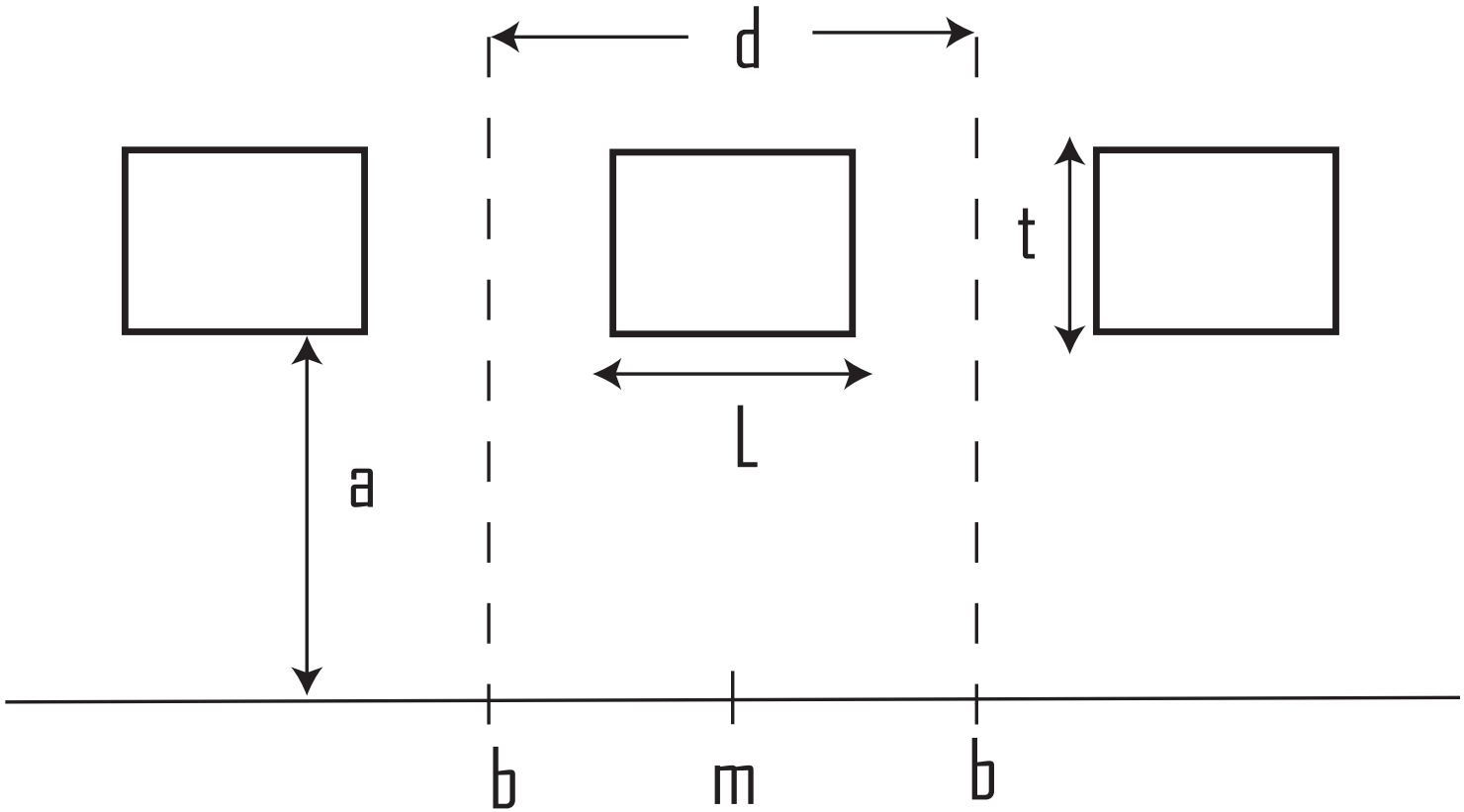
b = boundary
m = midplane



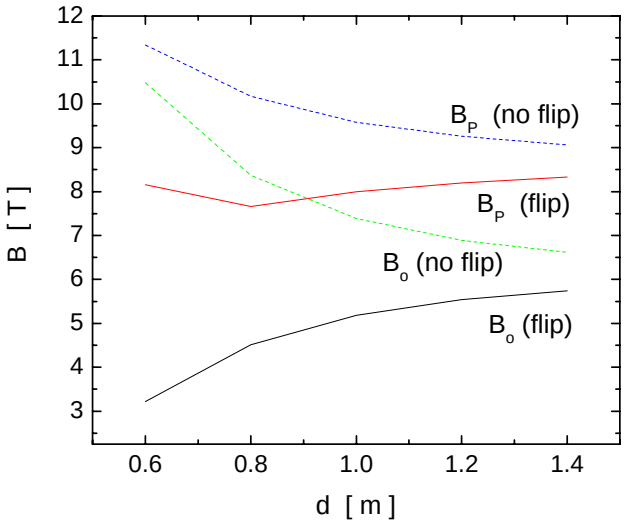
Study 2a

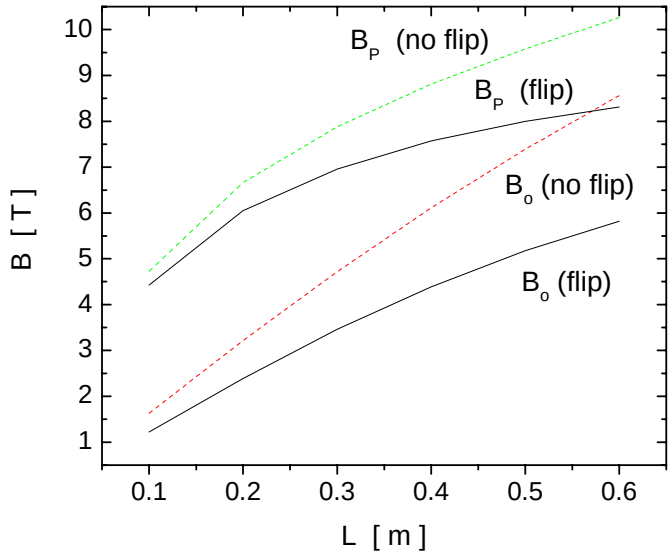
$<+|->_1$

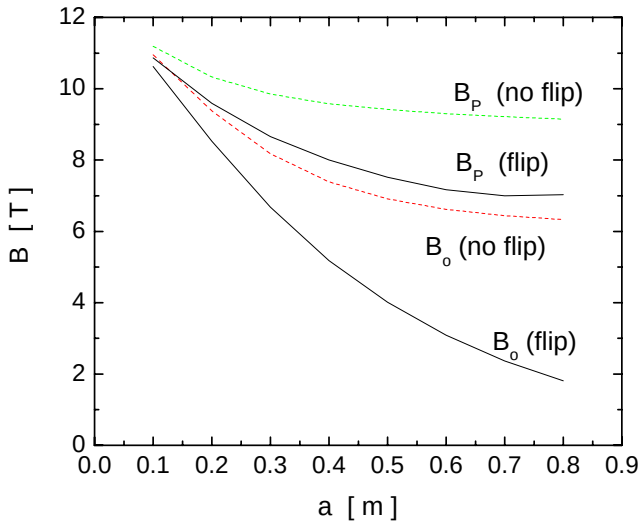
Lattice definitions



Peak field in coil



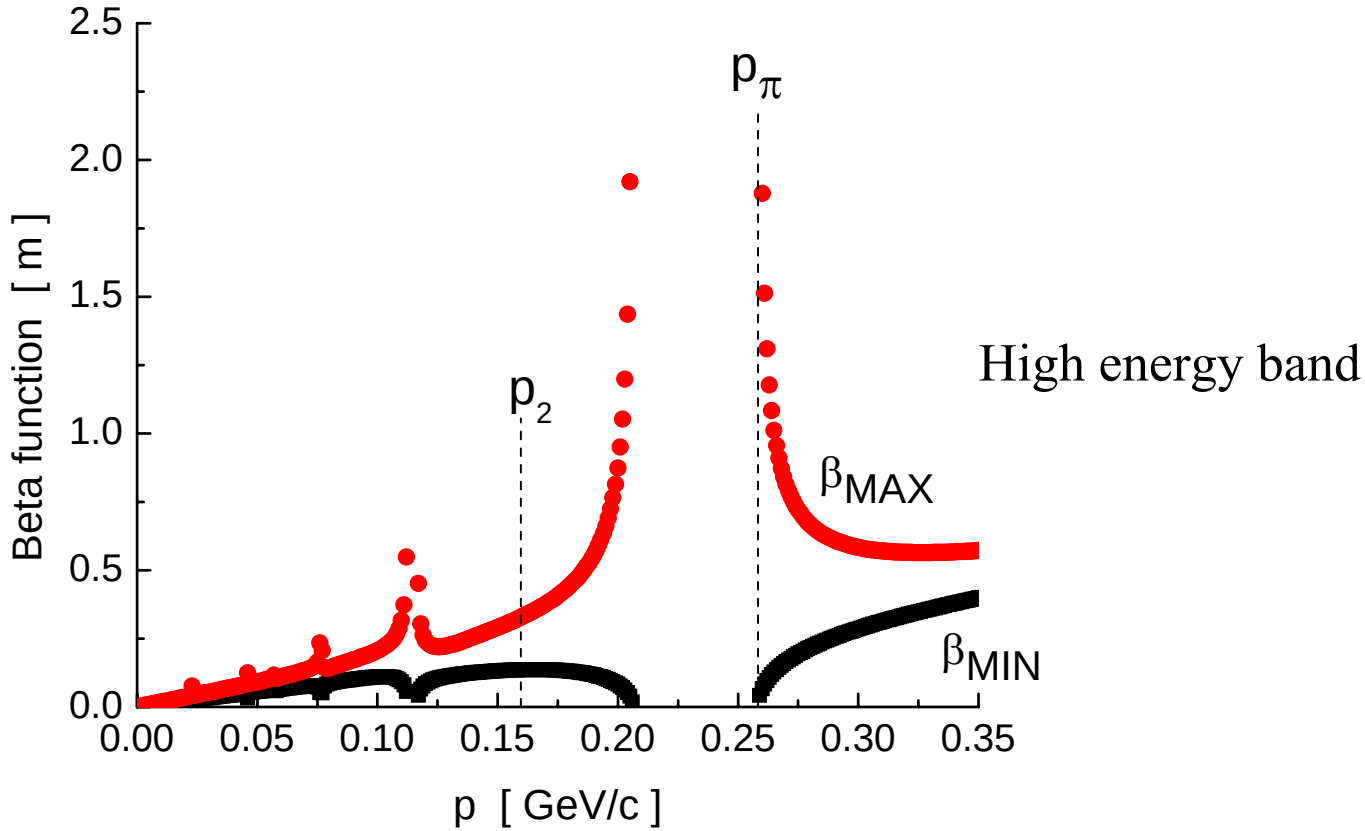




d = 100 cm
L = 50 cm
a = 40 cm
t = 10 cm
J = 100 A/mm^2

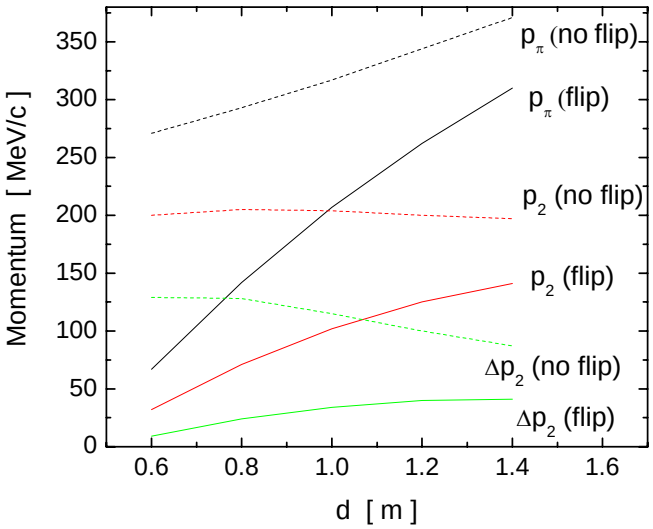
- look at sensitivity to changes
- peak B grows linearly with t or J

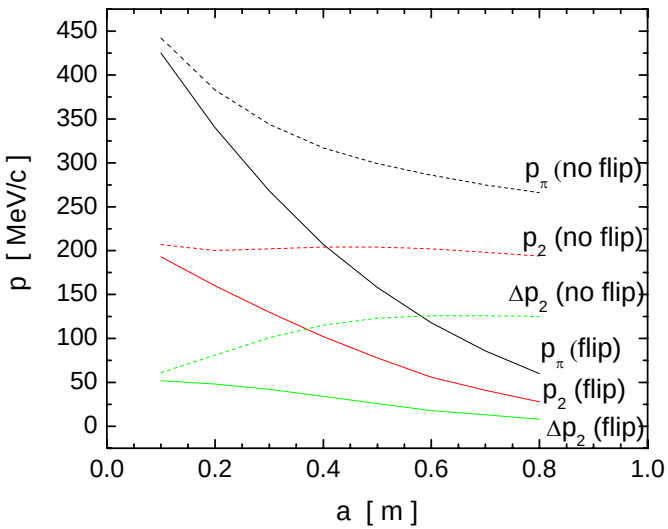
Momentum pass and stop bands



- beta function bounded in 2nd band

Location of bands





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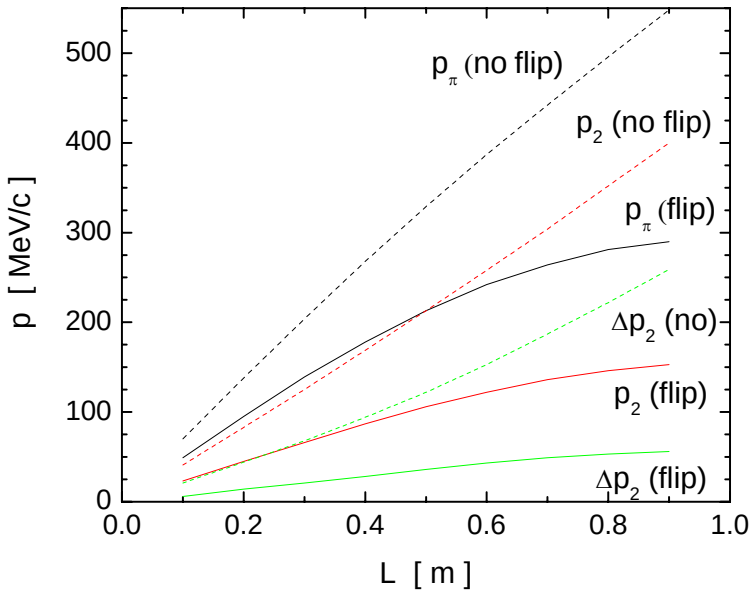
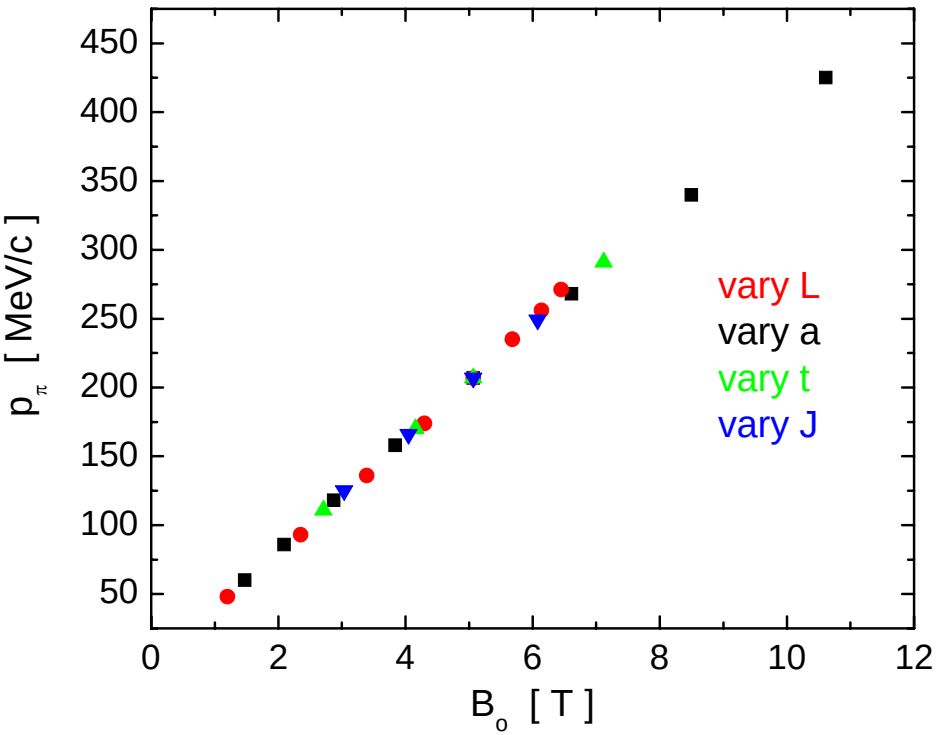


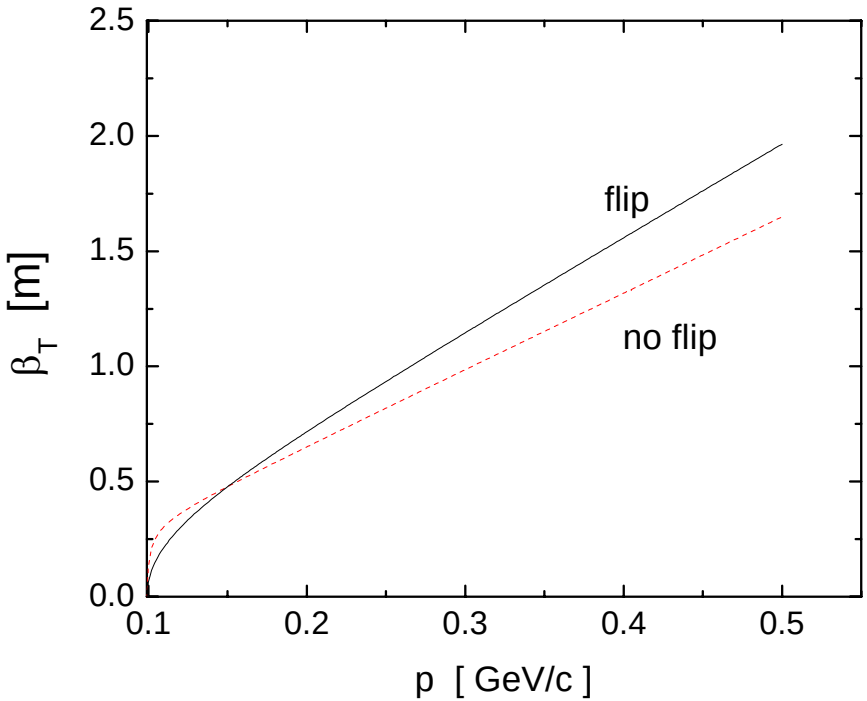
- look at sensitivity to changes
- p_π and p_2 grow linearly with t or J

Scaling



- pass band locations controlled by maximum on-axis field
- p_π depends linearly on B_o

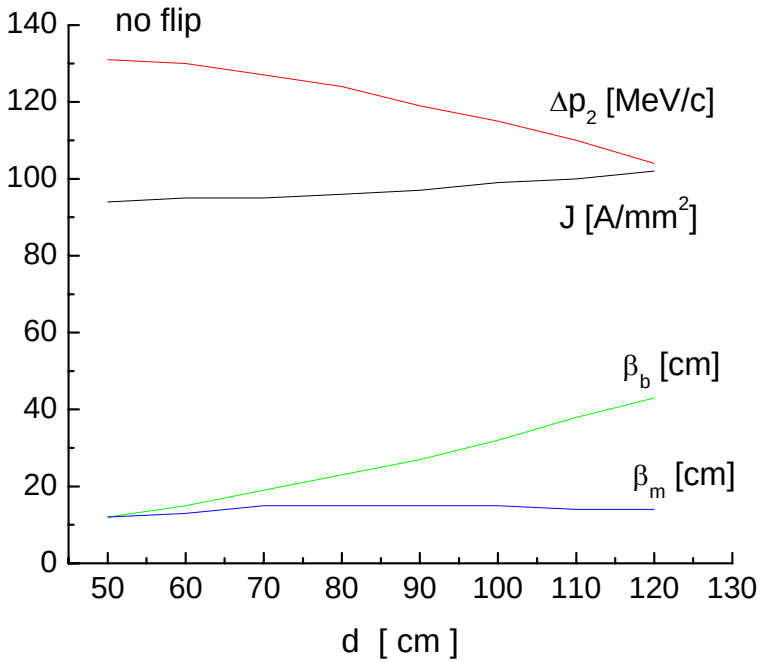
Beta for high energy pass band

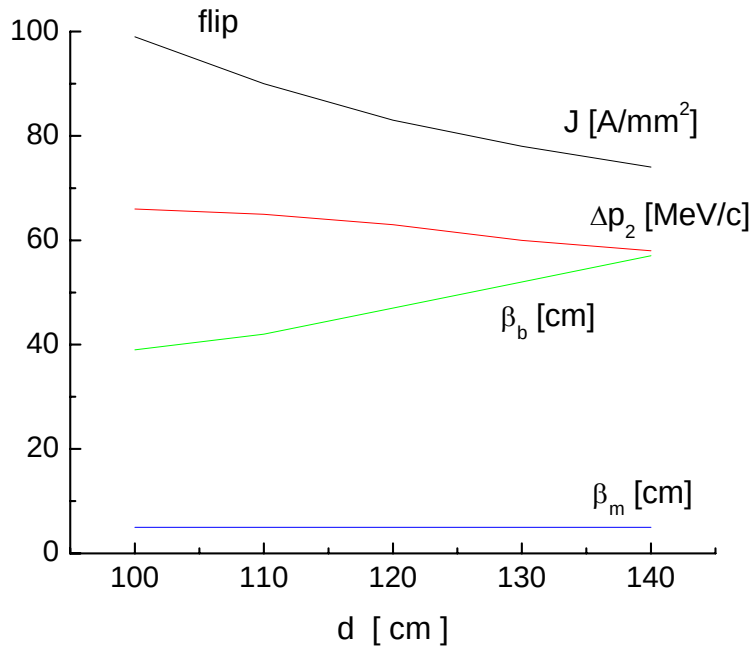


$p_\pi = 100$ MeV/c

- minimum beta controlled by momentum acceptance

Second pass band: vary d



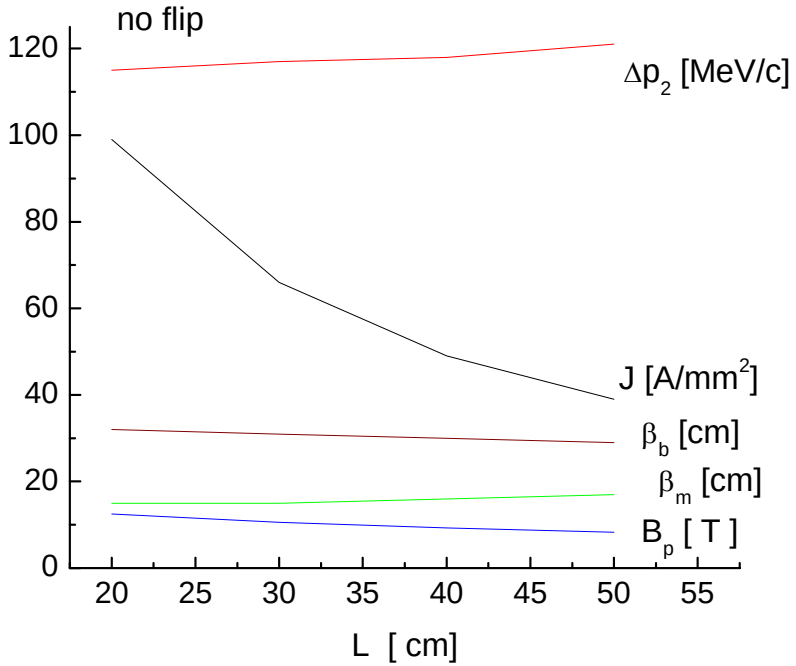


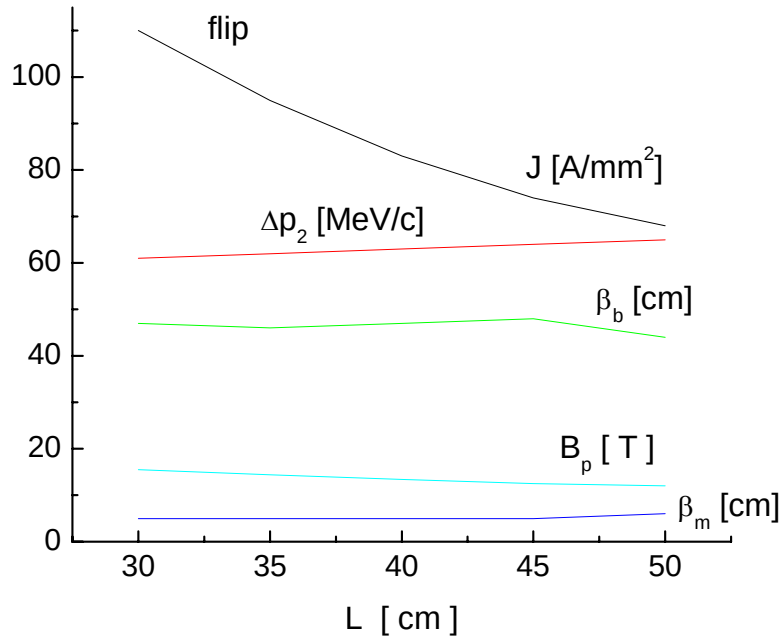
L = 20 cm
a = 40 cm
t = 24 cm

- keep p_2 fixed at 200 MeV/c
- different behavior of β_b and β_m
- only β_b is proportional to d

L = 40 cm
a = 35 cm
t = 24 cm

Second pass band: vary L



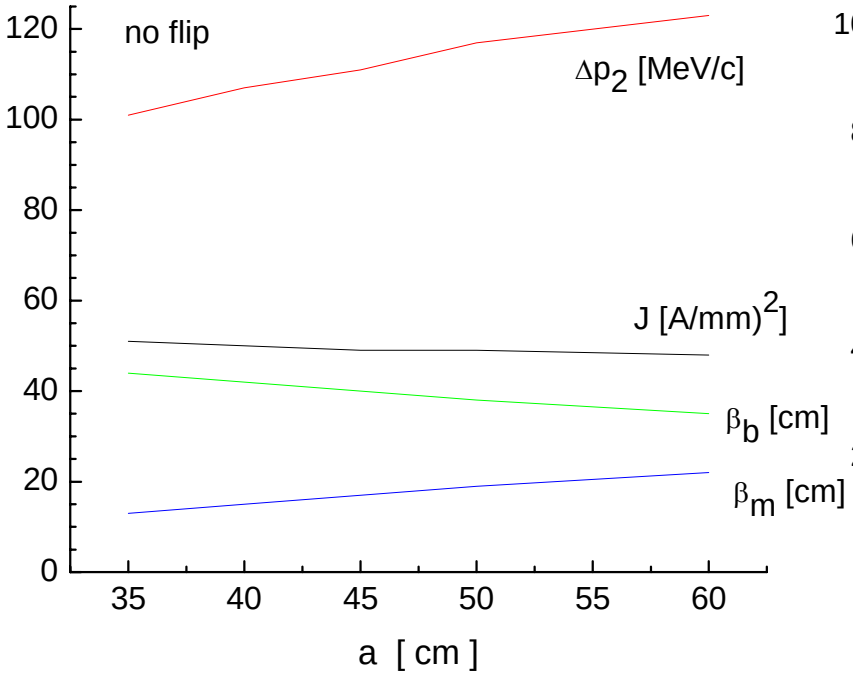


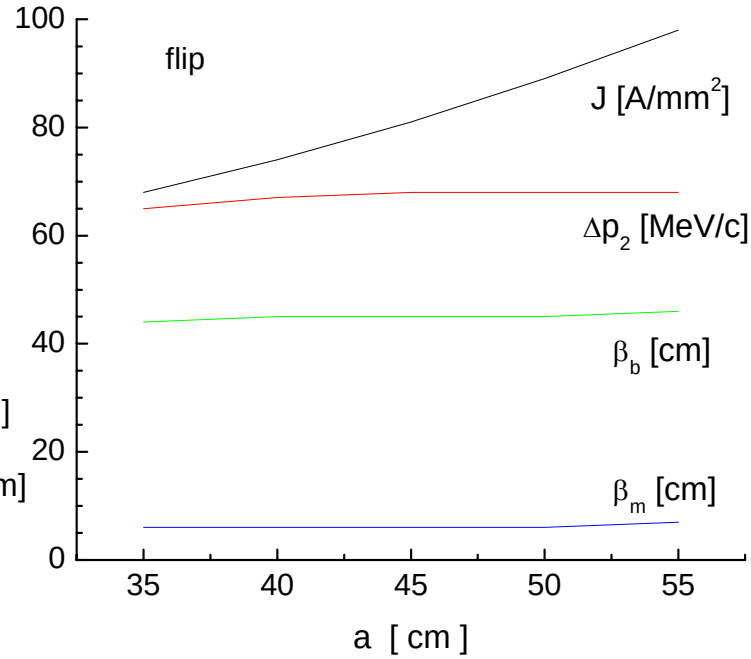
d = 100 cm
a = 40 cm
t = 24 cm

d = 120 cm
a = 35 cm
t = 24 cm

- minimum beta and acceptance ~independent of L

Second pass band: vary a



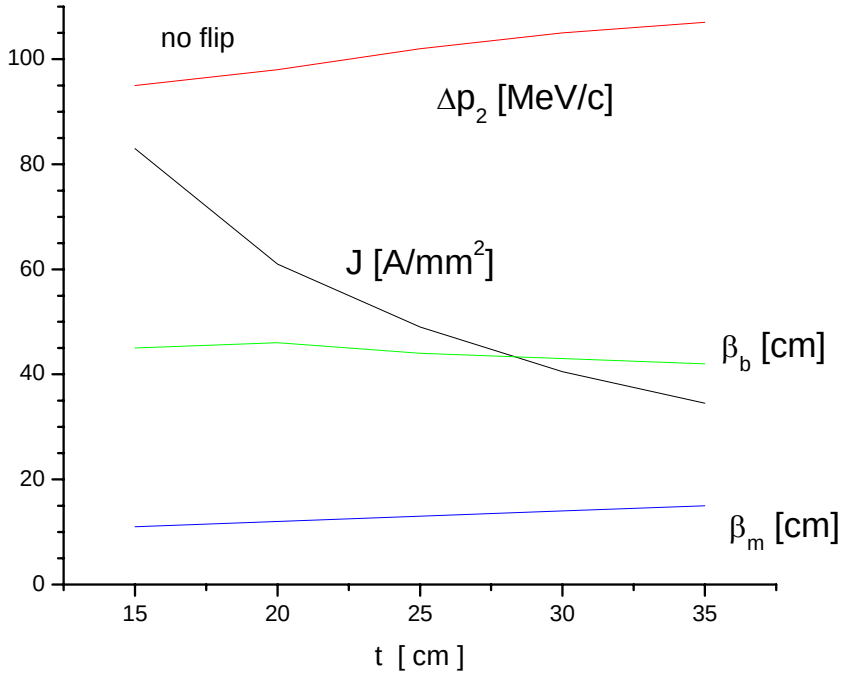


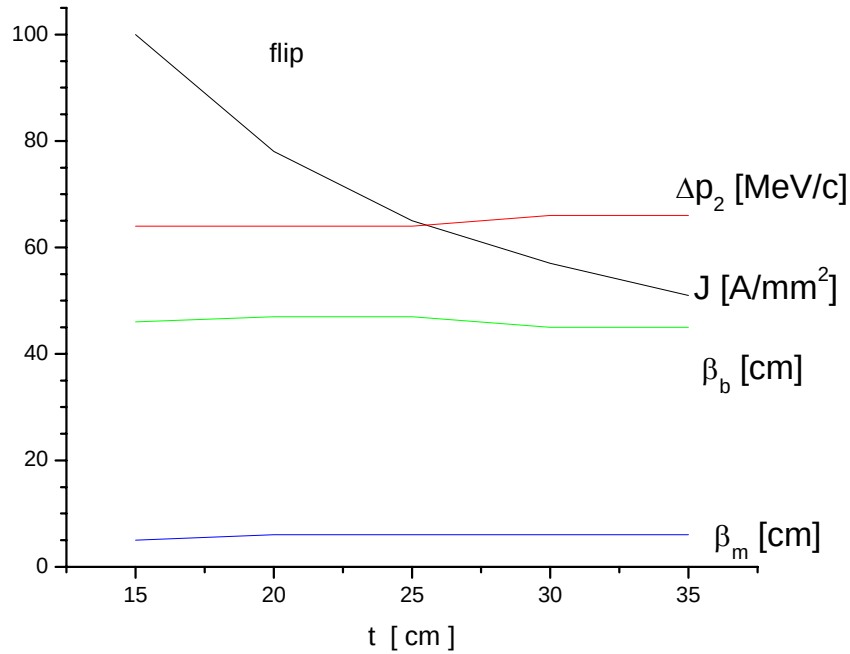
d = 120 cm
L = 40 cm
t = 24 cm

d = 120 cm
L = 50 cm
t = 24 cm

- minimum beta grows with a (no flip)

Second pass band: vary t



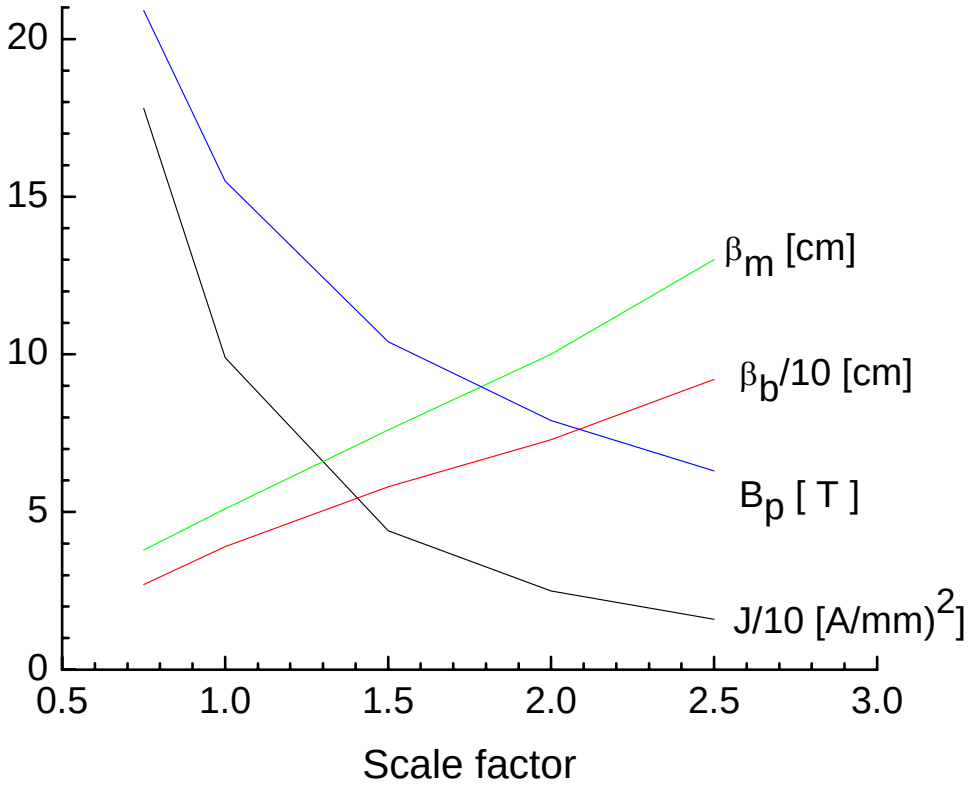


d = 120 cm
L = 40 cm
a = 35 cm

d = 120 cm
L = 50 cm
a = 35 cm

- minimum beta grows with t

Geometric scaling



SF = 1 for
d = 100 cm
L = 40 cm
a = 35 cm
t = 24 cm
flip

- J adjusted to give p_2 = 200 MeV/c
- beta at midplane small over large range of scale
- momentum acceptance independent of scale
- low ε example cf. R. Palmer, MCTF talk 12/14/06