04/03/2001

Is 3 Tesla Enough for the L Detector?

T. Maruyama

- No materials should be placed inside the beam-beam pairs boundary.

- The pair boundary depends on

  Solenoid field,
  IP beam parameters.

- Guinea-pig is used to generate pairs for 1000 GeV-B and 1000 GeV-H

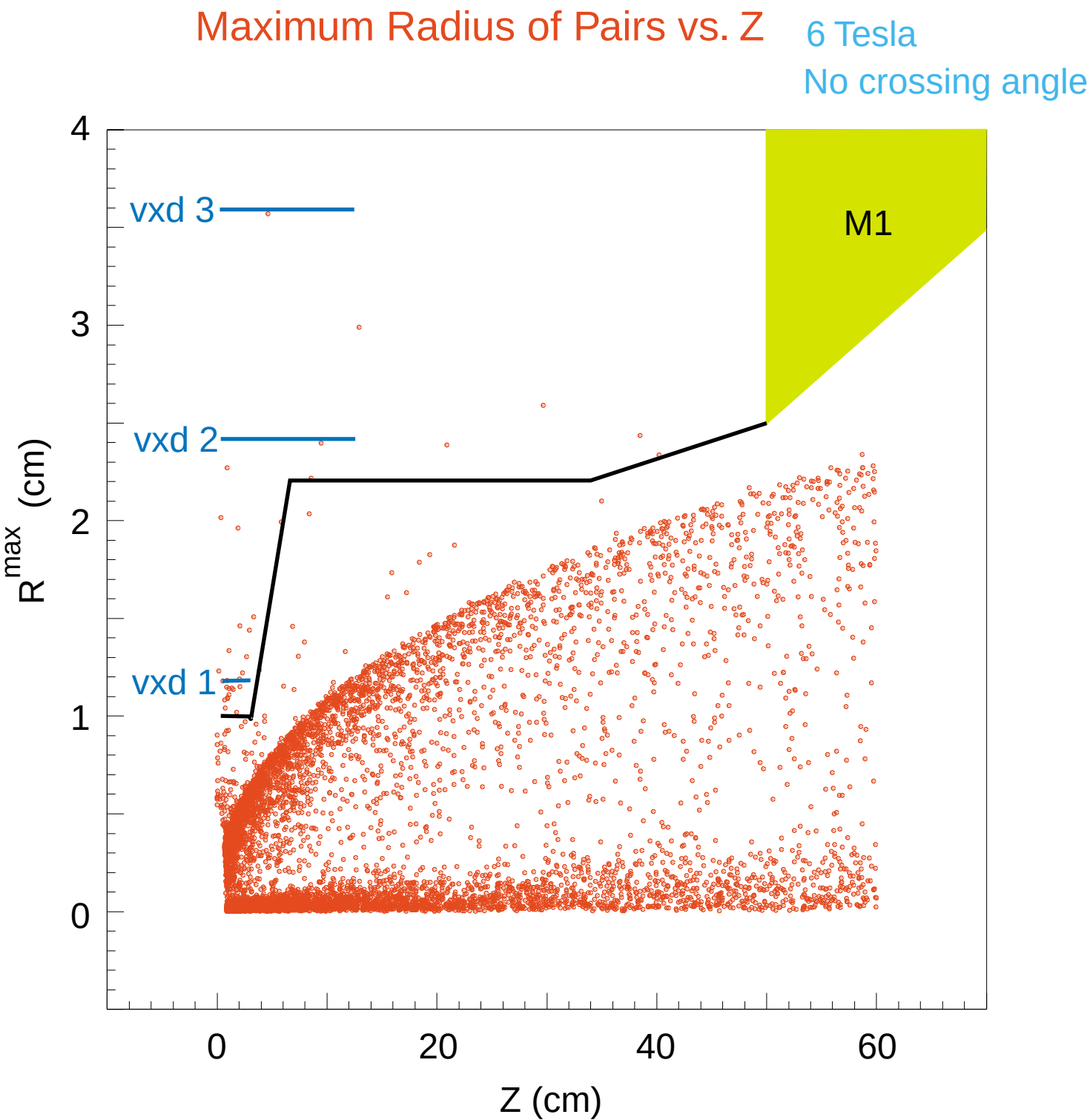
- Three options:

  3 Tesla + present geometry,

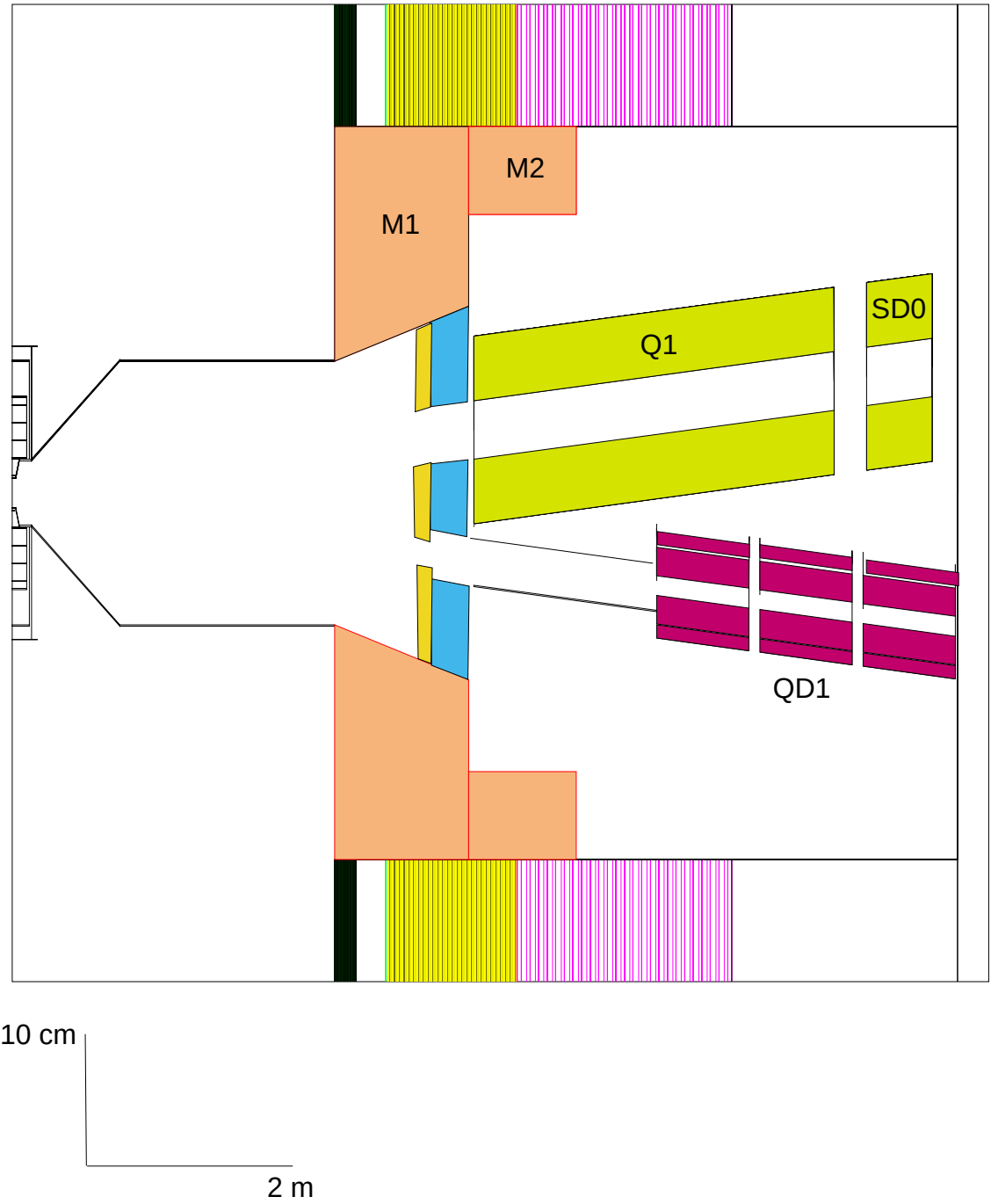
  4 Tesla + present geometry,

  3 Tesla + a few mm larger geometry.

e^+e^- Pair Background from Beam-Beam Interaction



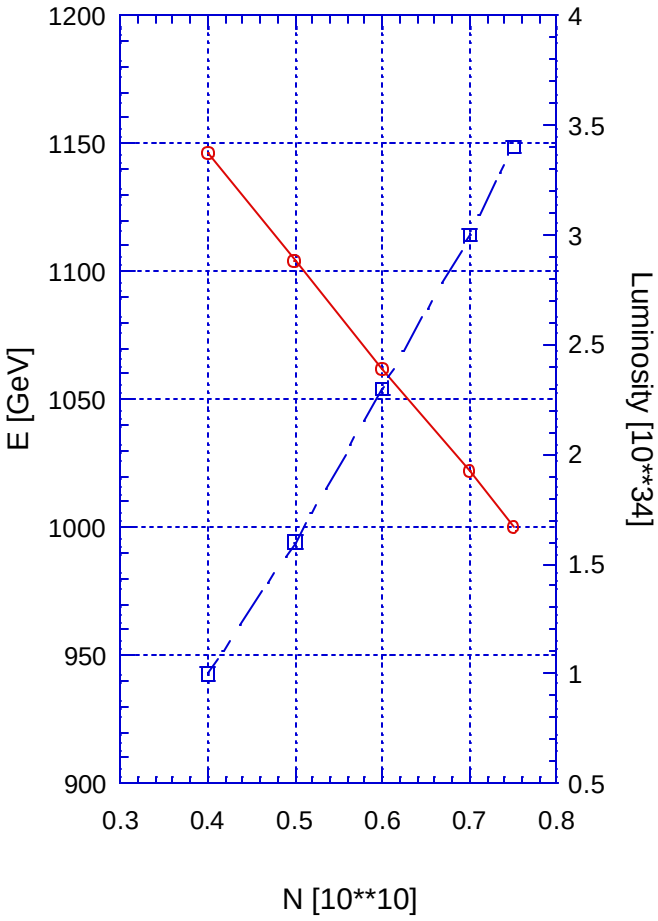
LCD Large Detector with L* = 4.3 m



Design Parameters

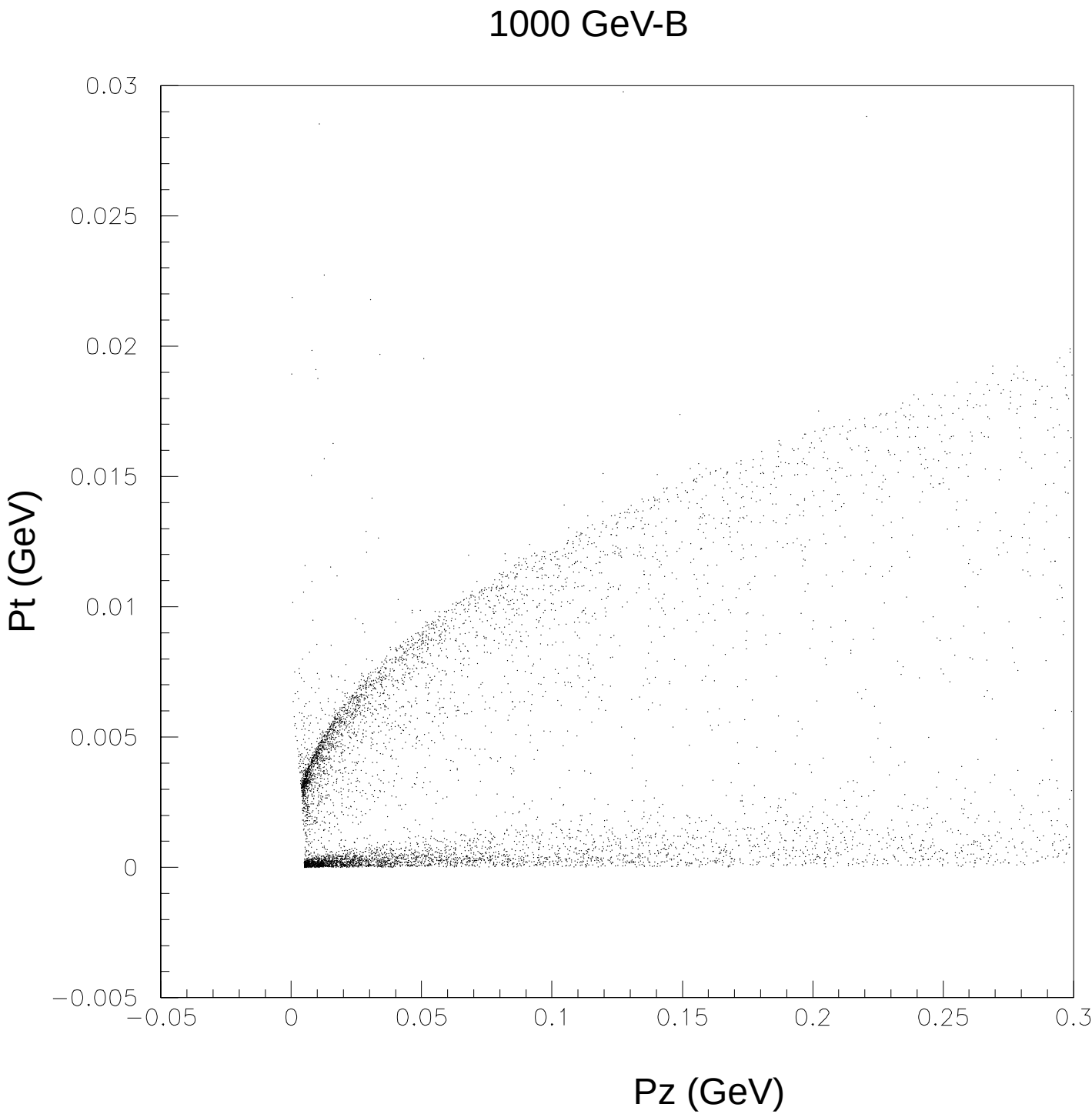
High E IP Parameters (3/01)	Stage 1	Stage 2
CMS Energy (GeV)	500	1000
Luminosity (10^{33})	**20**	**34**
Repetition Rate (Hz)	120	120
Bunch Charge (10^{10})	**0.75**	**0.75**
Bunches/RF Pulse	190	190
Bunch Separation (ns)	1.4	1.4
Eff. Gradient (MV/m)	**50.2**	**50.2**
Injected $\gamma\varepsilon_x$ / $\gamma\varepsilon_y$ (10^{-8})	300 / 2	300 / 2
$\gamma\varepsilon_x$ at IP (10^{-8} m-rad)	360	360
$\gamma\varepsilon_y$ at IP (10^{-8} m-rad)	**3.5**	**3.5**
β_x / β_y at IP (mm)	8 / 0.10	10 / 0.12
σ_x / σ_y at IP (nm)	**245 / 2.7**	**190 / 2.1**
σ_z at IP (um)	110	110
Yave	0.11	0.29
Pinch Enhancement	1.43	1.49
Beamstrahlung δB (%)	4.7	10.2
Photons per e+/e-	1.2	1.3
Linac Length (km)	6.3	12.8

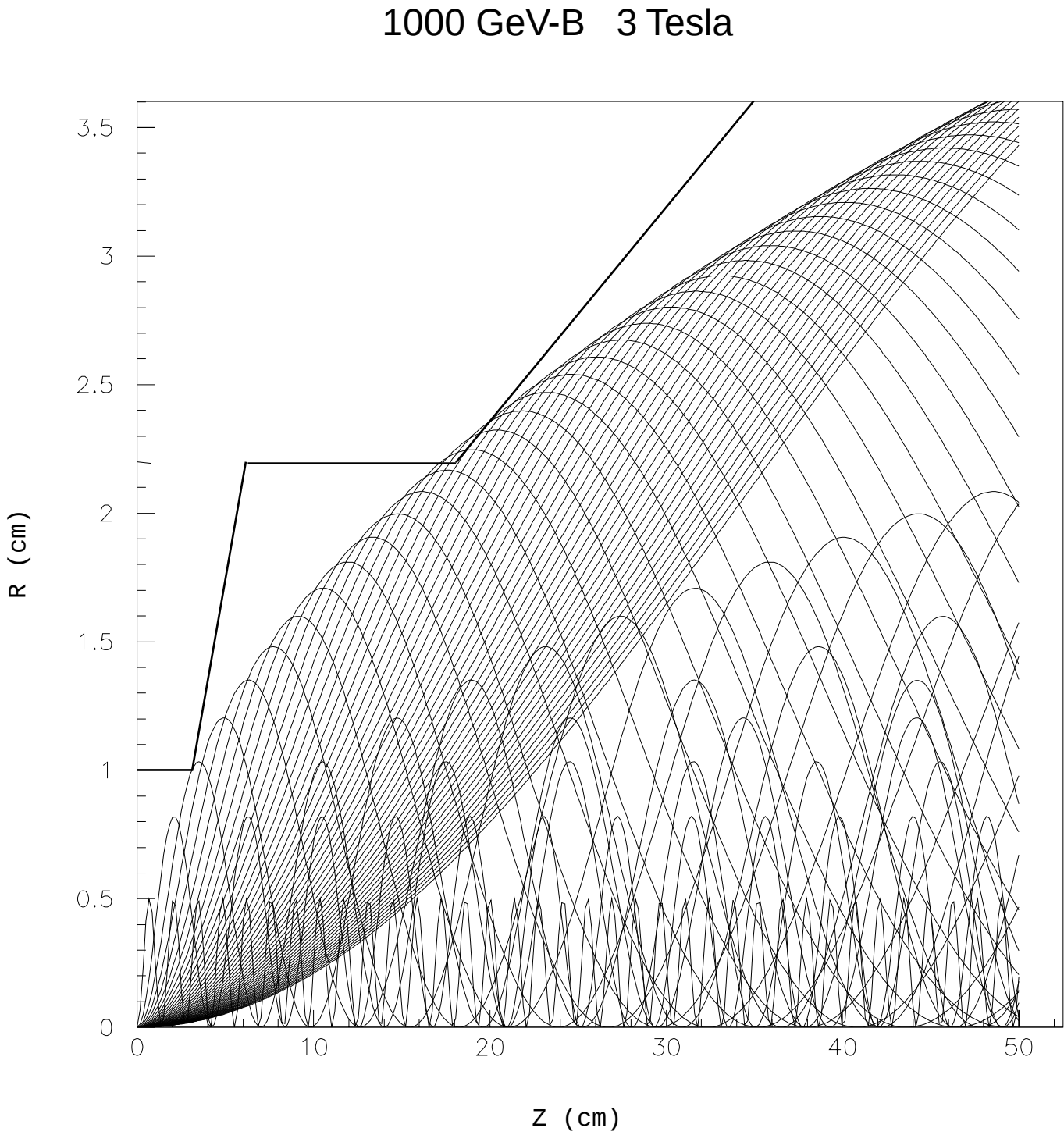
Beam Loading in Stage 2

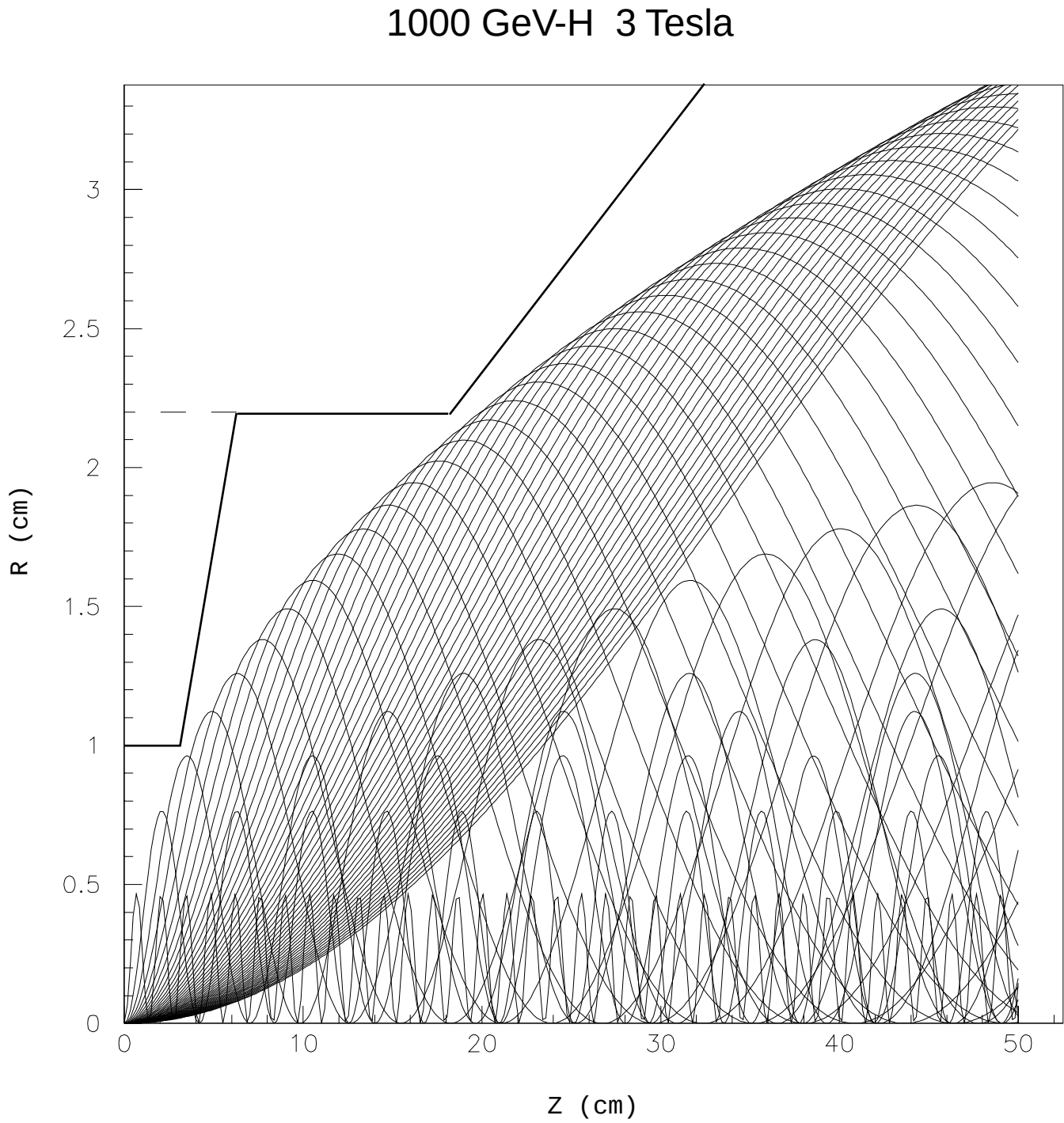


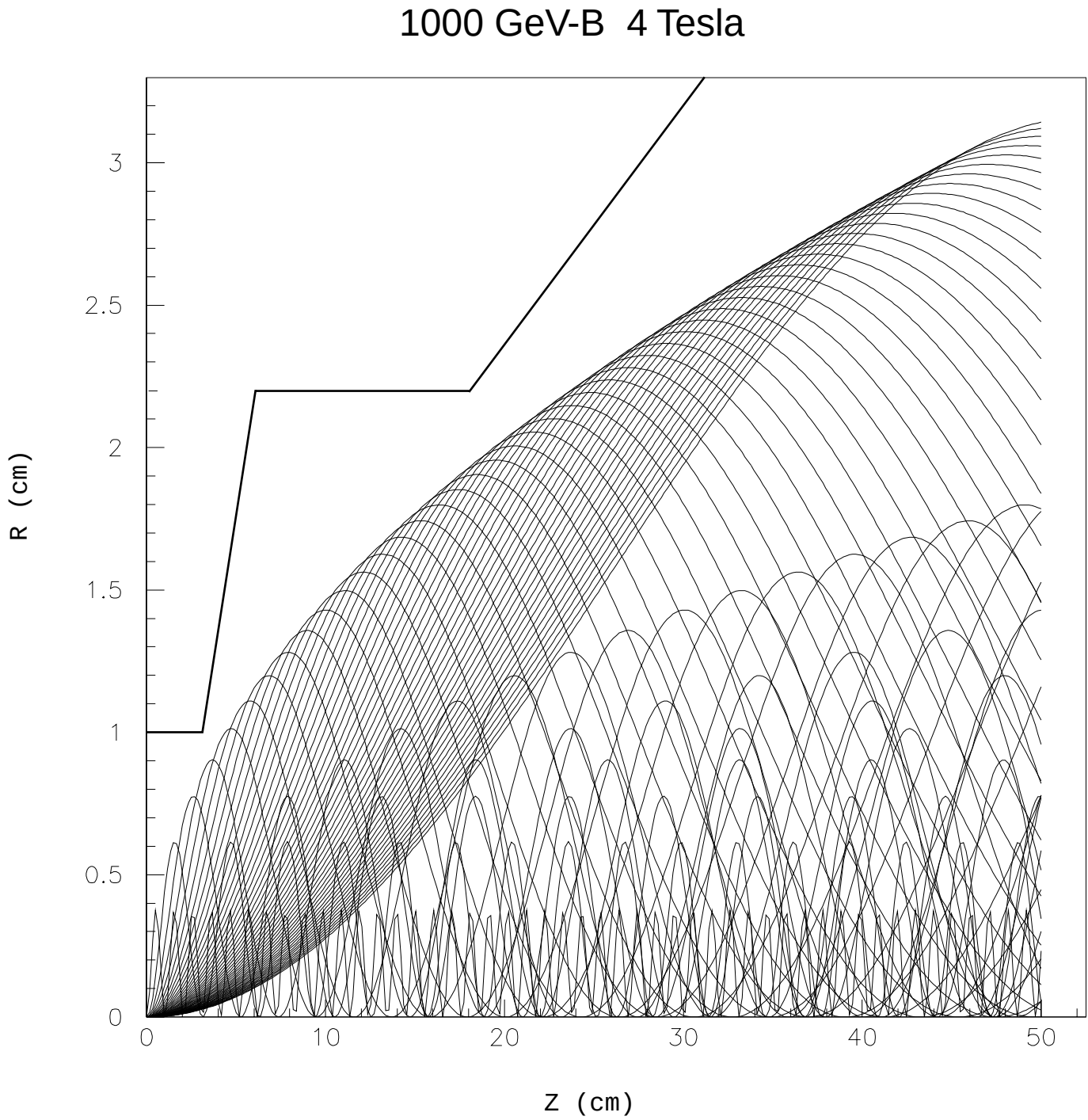
The second IR could be available for first physics, and later run simultaneously with shared luminosity.

Low Energy IP Parameters (8/00)			
CMS Energy (GeV)	**92**	**250**	**350**
Luminosity (10^{33})	**3.5**	**9.4**	**13.2**
Repetition Rate (Hz)	**120**	**120**	**120**
Bunch Charge (10^{10})	**0.75**	**0.75**	**0.75**
σ_x / σ_y at IP (nm)	**630 / 6.2**	**380 / 3.8**	**320 / 3.2**
L0 / Ltotal (%)	62	47	43
Beamstrahlung δB (%)	0.18	1.1	2
Photons per e+/e-	0.49	0.79	0.92
Polarization loss (%)	0.08	0.21	0.34


1000 GeV-B
Pt (GeV)
Pz (GeV)
0.03
0.025
0.02
0.015
0.01
0.005
0
−0.005
−0.05
0
0.05
0.1
0.15
0.2
0.25
0.3


1000 GeV-B 3 Tesla
R (cm)
Z (cm)
0
0.5
1
1.5
2
2.5
3
3.5
0
10
20
30
40
50


1000 GeV-H 3 Tesla
R (cm)
Z (cm)
0
0.5
1
1.5
2
2.5
3
0
10
20
30
40
50


1000 GeV-B 4 Tesla
R (cm)
Z (cm)
0
0.5
1
1.5
2
2.5
3
0
10
20
30
40
50