Vertex Detecor Radius (VDR) vs L* and luminosity

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- The main difference for the optimization of the final doublet between old and new FFs is that in the previous version the doublet had to be as short as possible to provide a decent energy bandwidth and luminosity for the system.
- New system is more forgiving although is still true that:

  Bandwidth~L*+L_qd0/2

  L_FF~L*+L_qd0/2

  but in the new FF the Bandwidth is much larger and its length is much shorter as starting with…

Criteria now used for choosing L*, L_qd0, L_01,L_qf1

- L* to simplify IR design and increase beam pipes apertures
- L_qd0 to allow the option of using a permanent magnet for qd0
- L_01 to minimize the vibration tolerances
- L_qf1 to minimize the luminosity loss due to synchrotron radiation

=> Everything want to be long…and the beam size across the doublet grows almost linearly with all the lenghts

What do we have now.

- L*=4.3m, L_qd0=3.3m, L_01=5.3m, L_qf1=4m
- Those values are consistent with a VDR of about 20mm.
- If the VDR becomes a requirement in the design of the IR, all the variables have to be reoptimized.
- Already decreased L_01=>1.8m in the “working versions” of the FF:

  20% horizontal smaller size across qf1

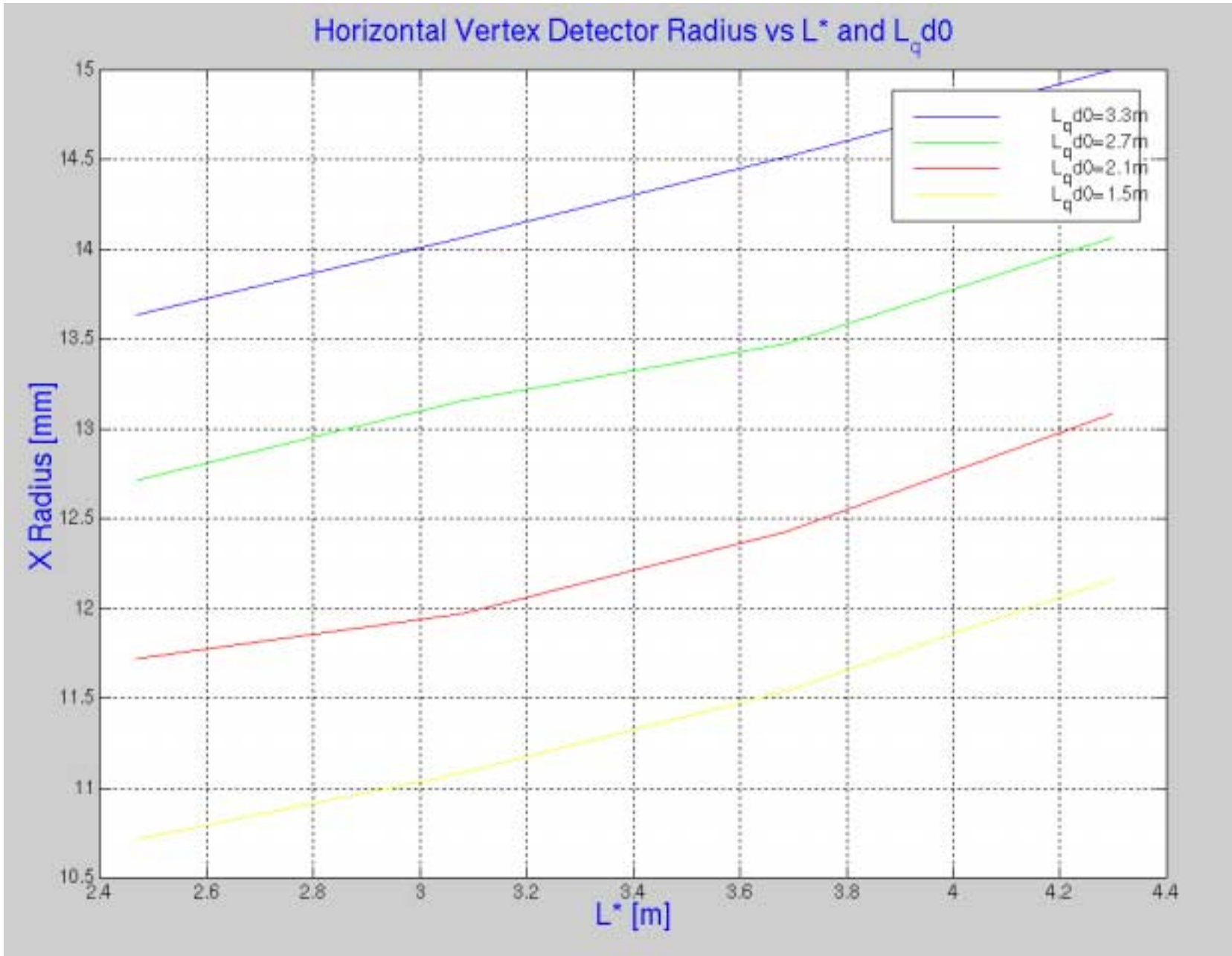
  15% stronger fields and tighter vibration tolerances

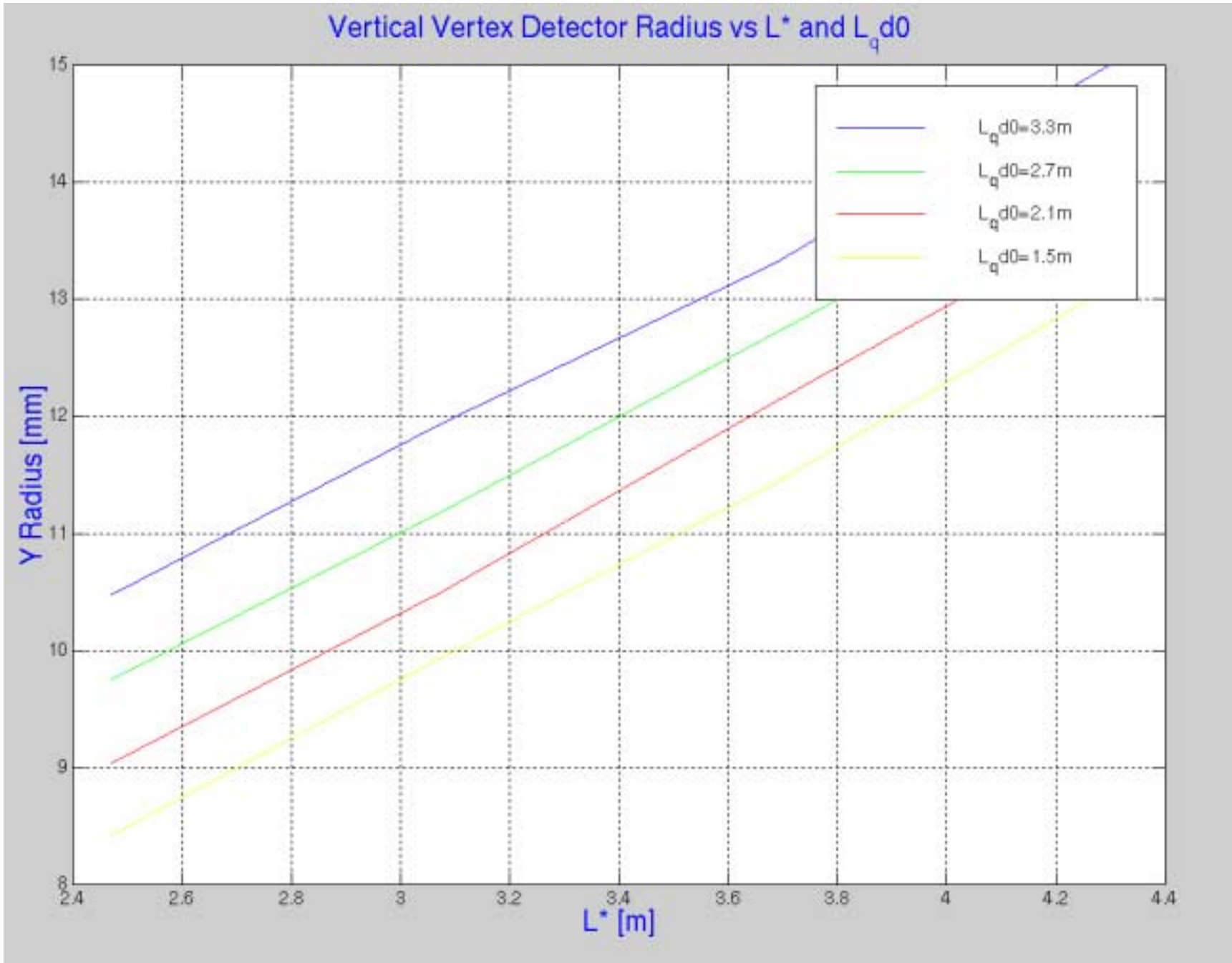
What more can we do

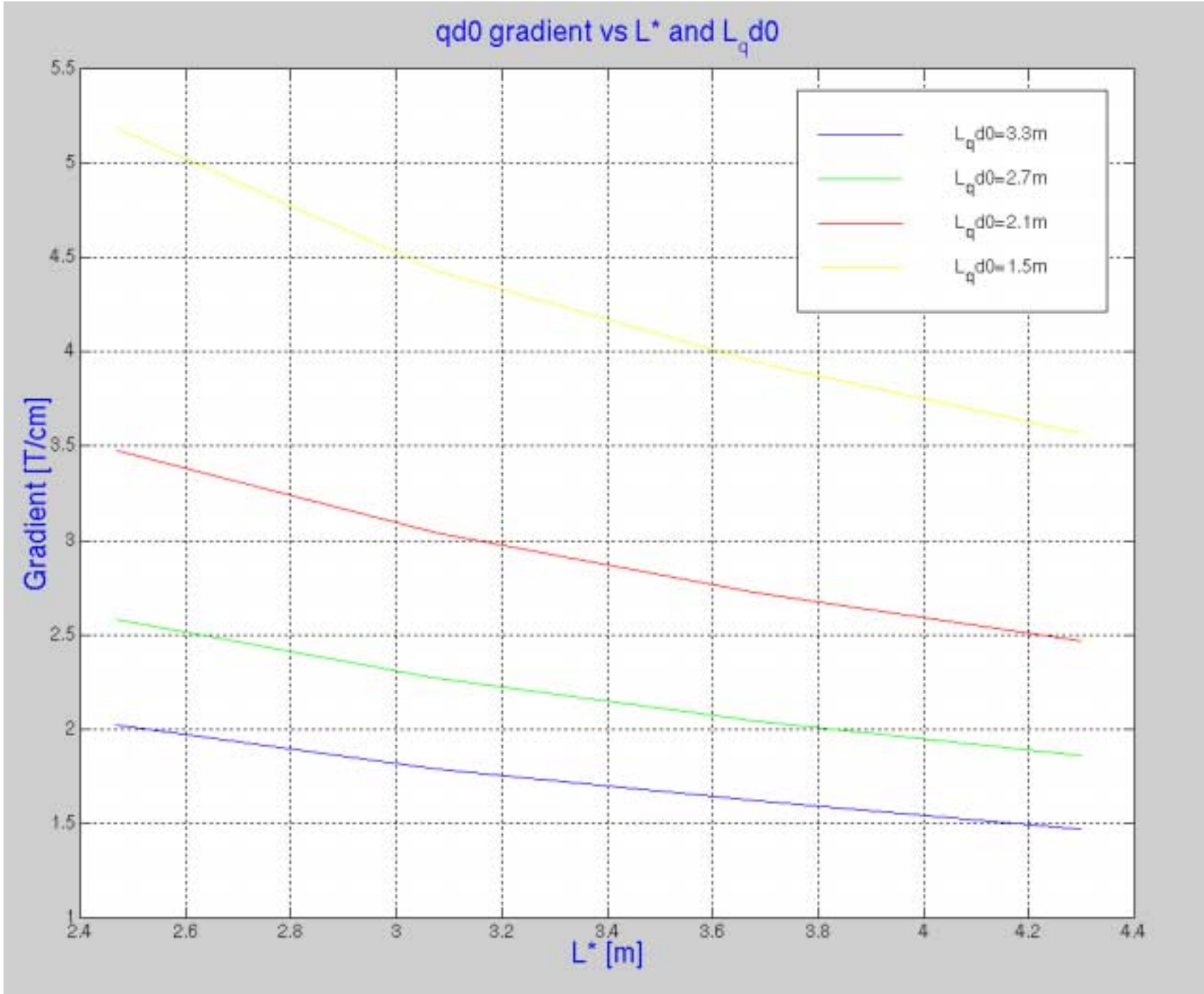
- Decrease L*
- Decrease L_qd0

L_qf1 should stay roughly untouched since is already causing about 3% luminosity loss from synchrotron radiation.

The option of a permanent magnet for qd0 has to be abandoned


Horizontal Vertex Detector Radius vs L* and Lqd0
X Radius [mm]
L* [m]
LqdO=3.3m
LqdO=2.7m
LqdO=2.1m
LqdO=1.5m
15
14.5
14
13.5
13
12.5
12
11.5
11
10.5
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4


Vertical Vertex Detector Radius vs L* and Lqd0
Y Radius [mm]
L* [m]
LqdO=3.3m
LqdO=2.7m
LqdO=2.1m
LqdO=1.5m
15
14
13
12
11
10
9
8
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4


qd0 gradient vs L* and Lqd0
Gradient [T/cm]
L* [m]
LqD0=3.3m
LqD0=2.7m
LqD0=2.1m
LqD0=1.5m
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4

Conclusions

- With some small deterioration of the properties of the system we could conceive to have a VDR of about 10mm
- I don’t foresee that anything smaller could be installed in NLD upon previous experience with real beams on the real machine.