Cross-check of solenoid effects in BDSIM&DIMAD and plans

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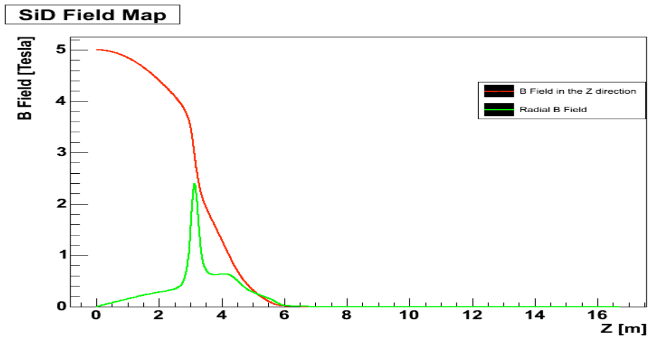
Crosschecking Solenoid Effect

- Aim to cross check BDSIM tracking in the solenoid field - with the coupling of the focussing elements
- Using the following common set up:
  - NLC 20mrad optics
  - L* = 3.5m
  - Using SiD field map
- Comparing results to B.Parker, A.Seryi (SLAC-TN-04-044)



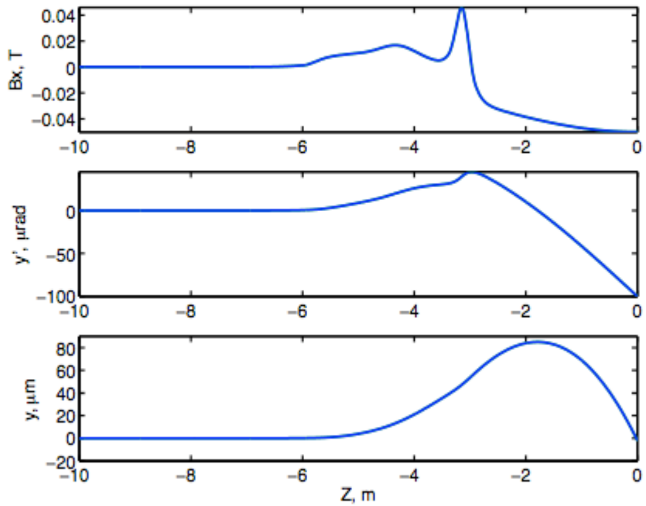


Figure 6: Beam orbit in SiD calculated in assumption of absence of any focusing elements (by simple integration of solenoid B_x). No compensation of the IP angle is applied yet.

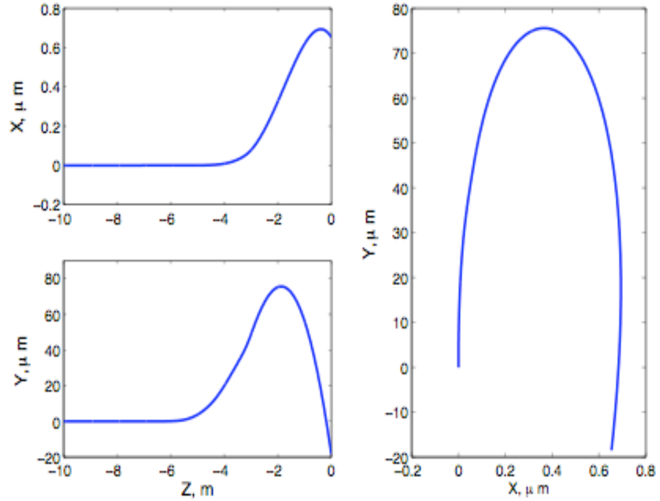
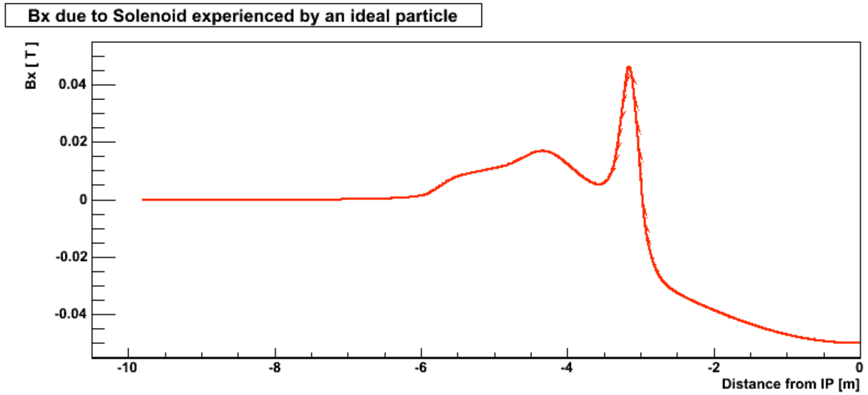
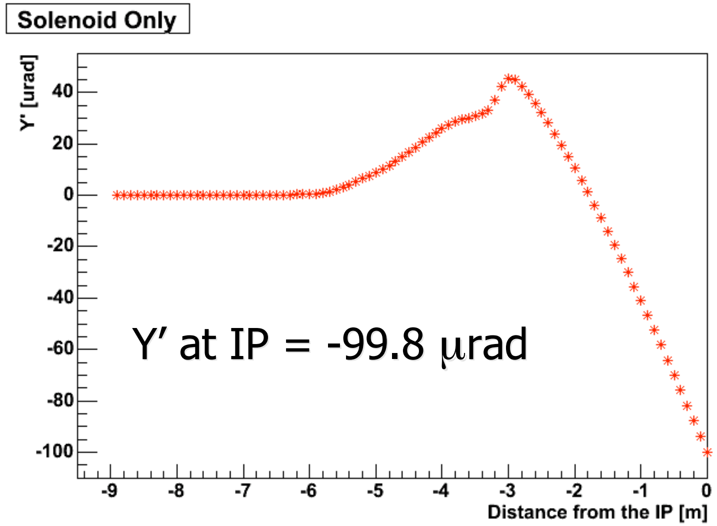
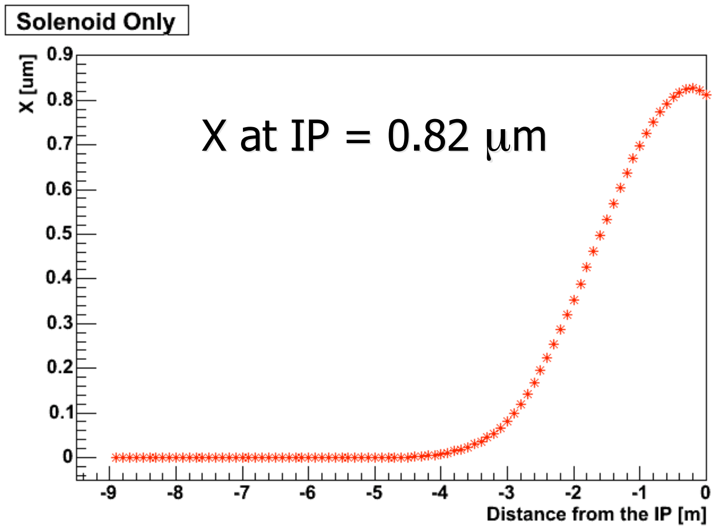


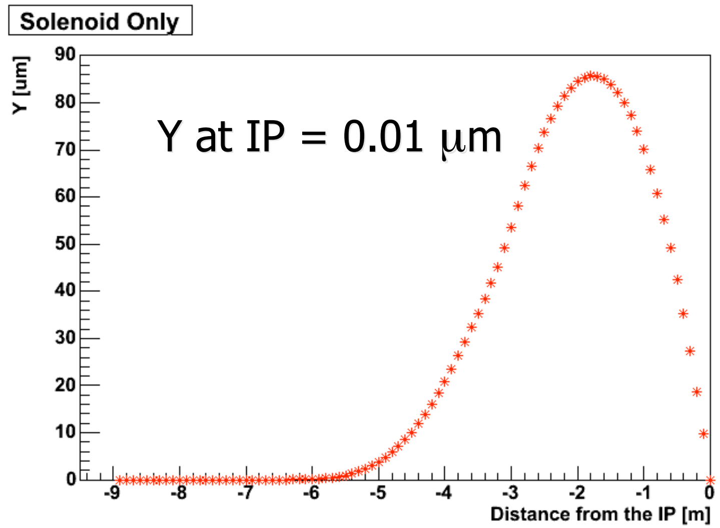
Figure 7: Beam orbit in SiD determined by tracking with DIMAD. No compensation of IP angle applied yet. The IP beam coordinates are: $x = 0.65$ μm, $y = -18.5$ μm, $x' = -0.21$ μrad, $y' = -104$ μrad.

Solenoid - no focussing elements

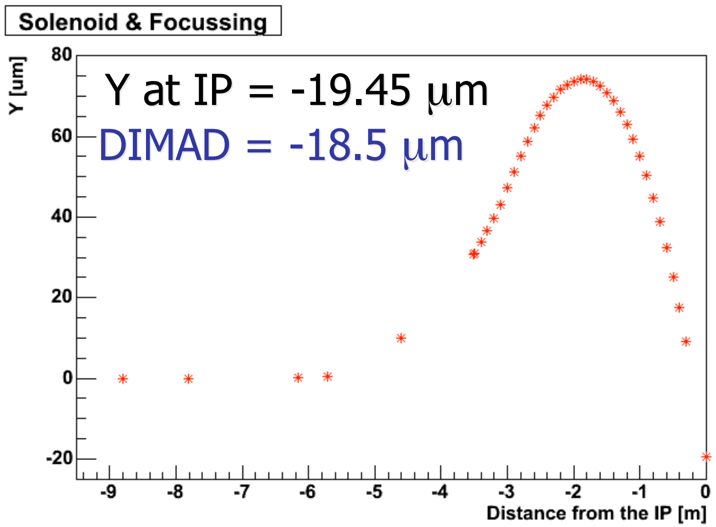


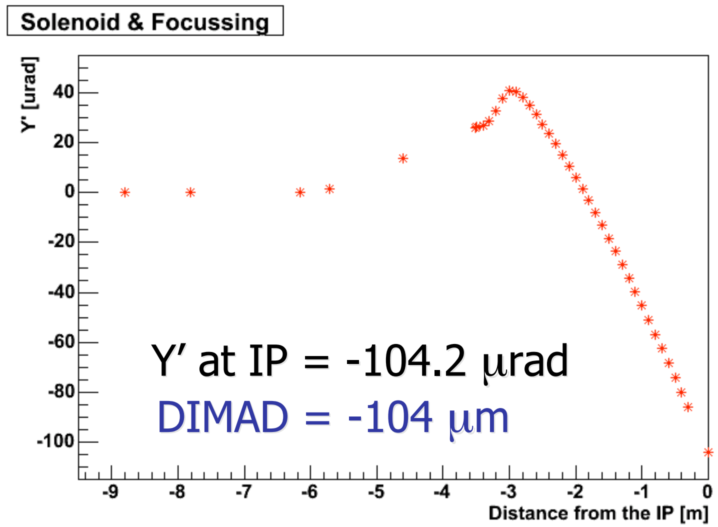


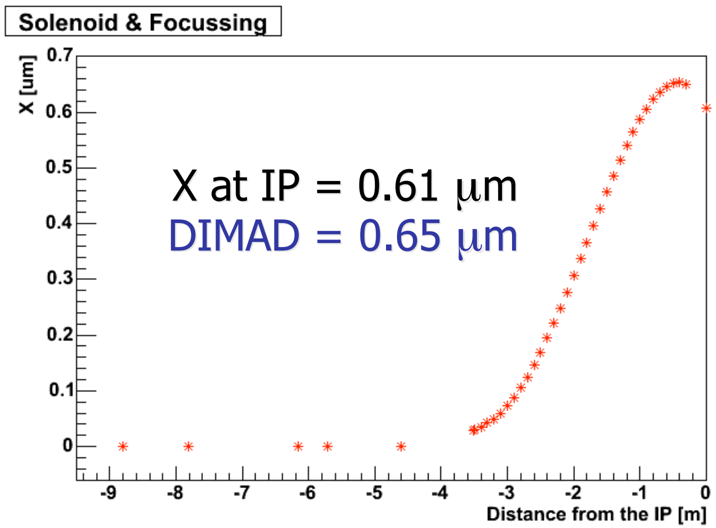


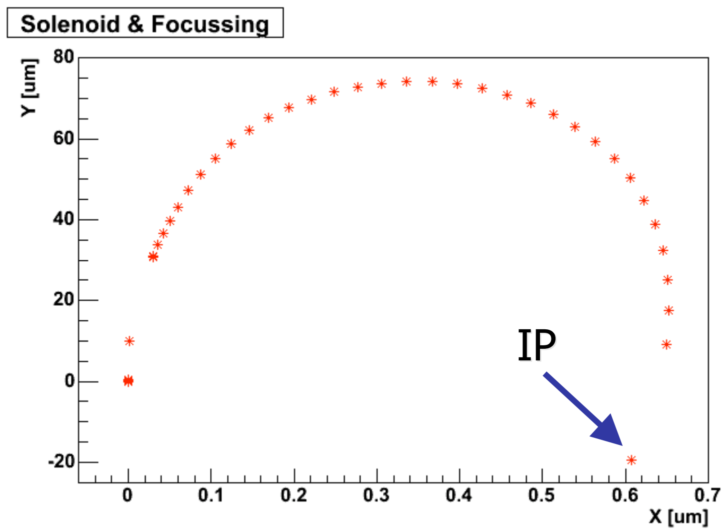


Solenoid & Focussing elements





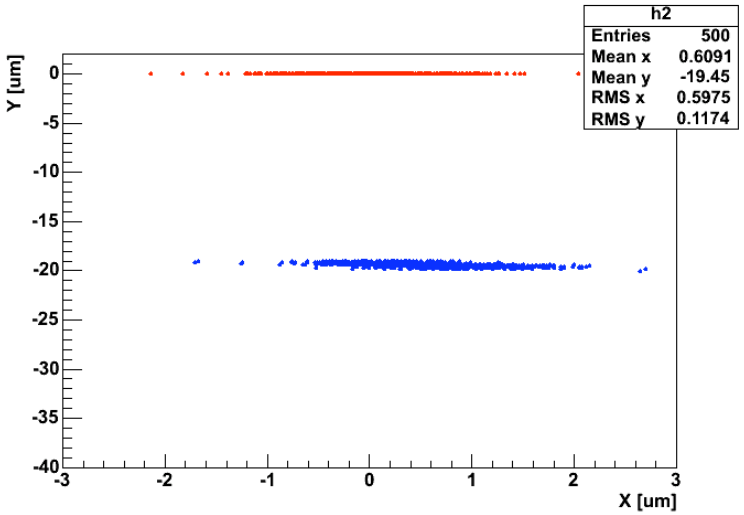




Differences could be due to interpolation of the field - map only gives Bz to nearest cm

Solenoid Effects

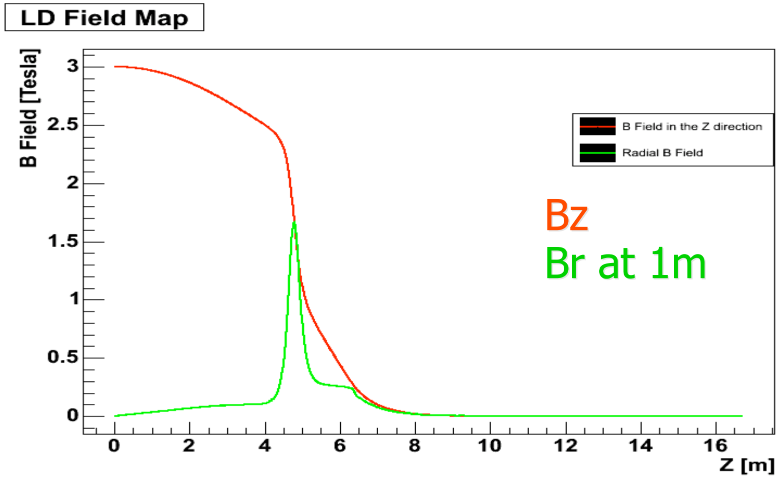
- Coupling of focussing elements and the solenoid field results in an offset at the IP of the angle and position
  - Significant for the core beam
  - Does not appear to be so important for the halo (in terms of the SR cone)



- Can be compensated by offset quads or kickers but produces a large deviation in the vertical orbit (~4mm)
  - Not yet shown in BDSIM

Short Doublet Set Up

- Using latest doublet parameters for L*=4.5, 1TeV set up
  - Improved design to fit in with more realistic magnet technology
  - Changed solenoid field map from TESLA TDR to LD (~GLD)

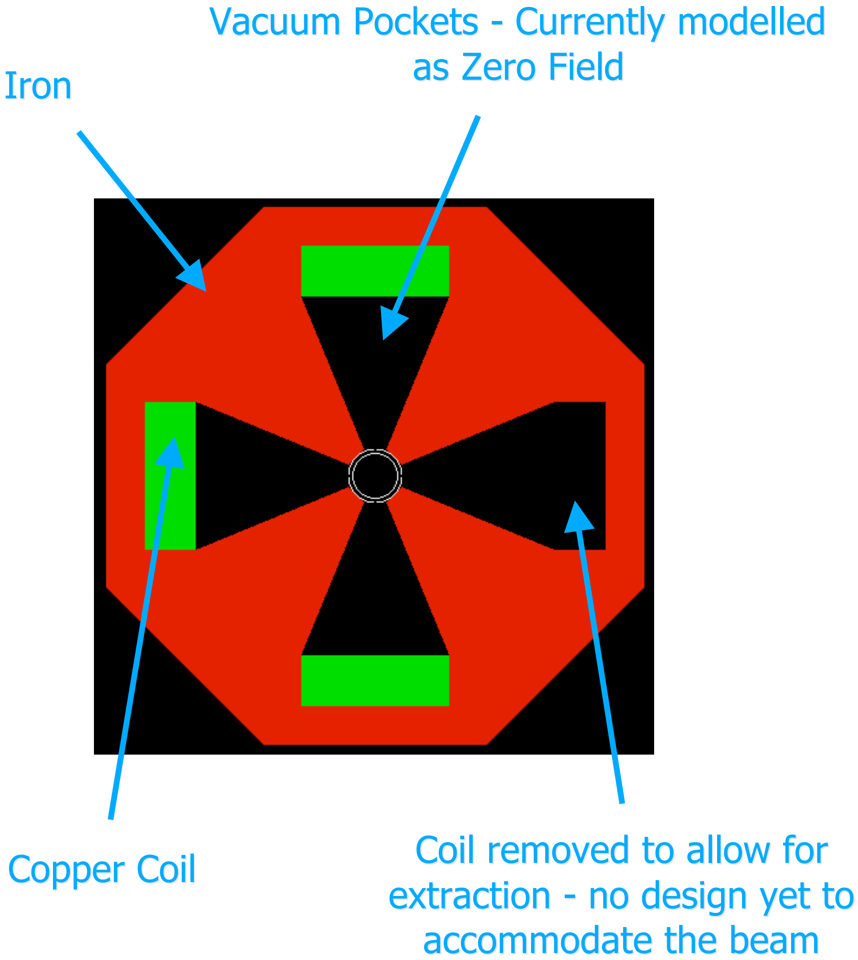


	Strength	Length [m]	Aperture Radius [mm]
L*	-	4.500	≥12
QD0	K1=-0.0956	2.500	35
D1A0	-	1.3299	80
SD0	K2=0.6189	3.800	80
D1B	-	3.883	80
QF1	K1=0.0403	2.000	10

L* - QD0 - D1A0 - SD0 - D1B - QF1…

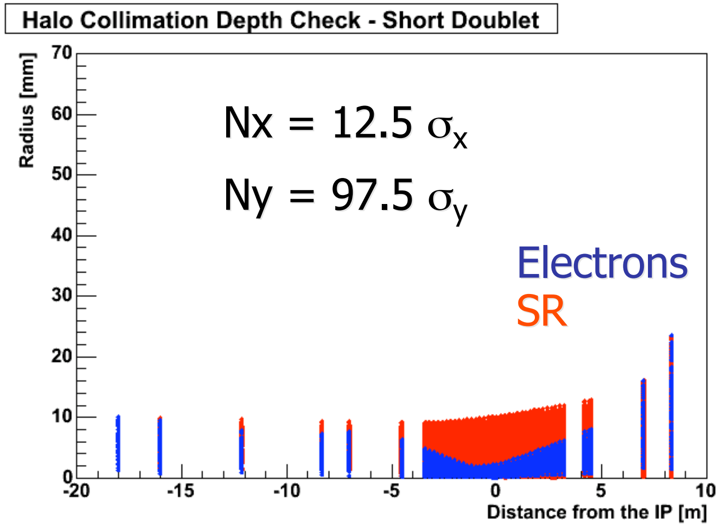
Halo Collimation Depth Checks

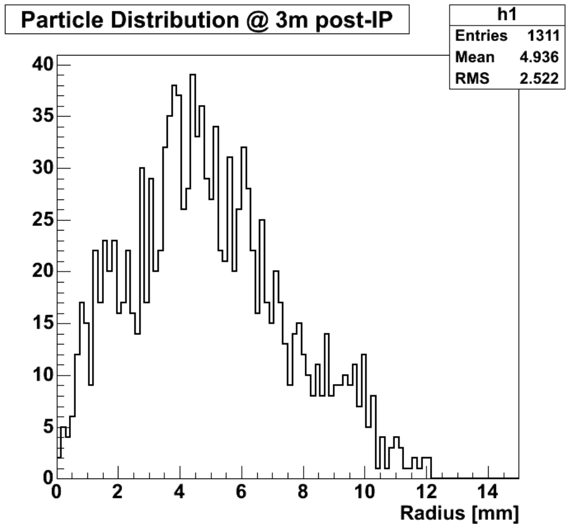
- Warm QF Magnet implementation in BDSIM updated to be more realistic
- Not to exact specifications…
  - 1st order model to give surface area for reflected particle studies and volume for energy load
- This quad could be a major constraint in the Halo collimation depth
  - Previous values calculated used a Mask at 3m post IP as the constraint.
    - (F.Jackson, DL, presented at ILC-BDIR 2005)
  - First look shows that Halo electrons may hit QF beampipe or travel through a pocket (in a relatively low field)
    - Causes a problem with the larger aperture of QD0
    - May need to apply full field map to this quad - especially for studying extracted beam behaviour

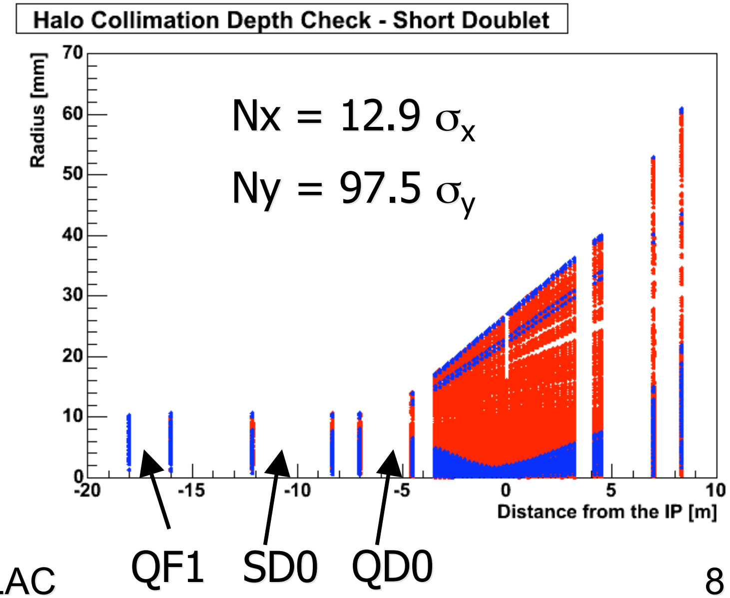


Halo Collimation Depth Checks

- Assumed Nominal 1TeV IP parameters:
  - β_x = 30mm
  - β_y = 0.3mm
- Limited statistics used here - only a few 100 electrons fired based on a flat halo distribution
- Started with Nx = 16.5 and Ny = 97.5
  - Only modified Nx so far
- Need to run with higher statistics







Plans

- More detailed Halo Collimation Checks underway
  - Start by constraining collimation depths in the IR
  - Then use this Halo distribution to check collimation performance along the BDS
    - Check hard edge performance
    - Check background issues arising from showering at the Collimators
  - Collimation Depth Vs Backgrounds in the IR

- Check feasibility of latest 'short doublet' parameters
  - Reflection off of QF1
  - Energy loads on focussing elements

First look at Halo & SR at QF1. 6000 halo electrons generated - all of which goes through pocket of QF1

(Using Nx = 12.5 σ_x and Ny = 97.5σ_y)