IR Backgrounds in the 2mrad short doublet scheme using BDSIM

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- IR Geometry & Field Map Setup
- Pairs Backgrounds
  - Incoherent Pairs
  - Radiative Bhabhas
- Halo Generation
- Halo Collimation Depth Requirements
  - Vertex Detector Hits
- Conclusions & Outlook

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ILC - BDIR

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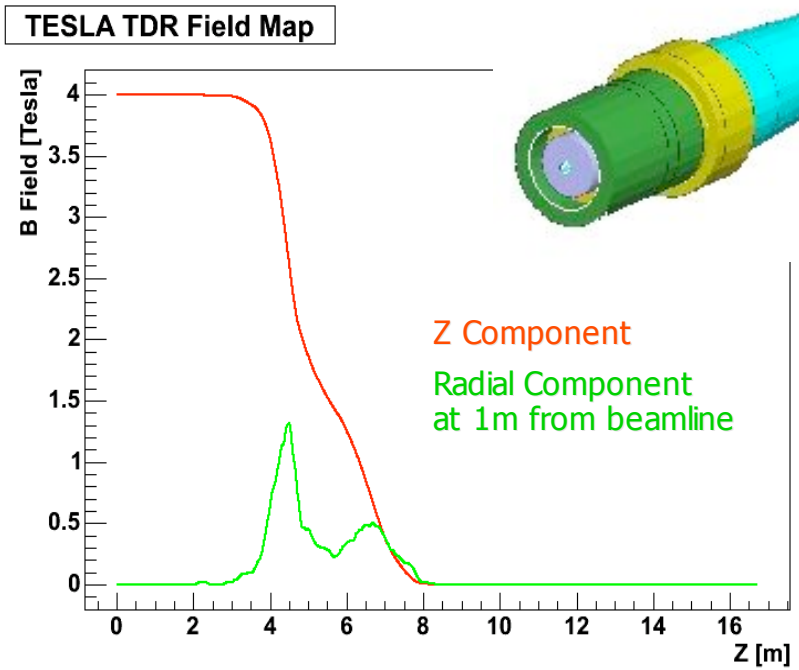
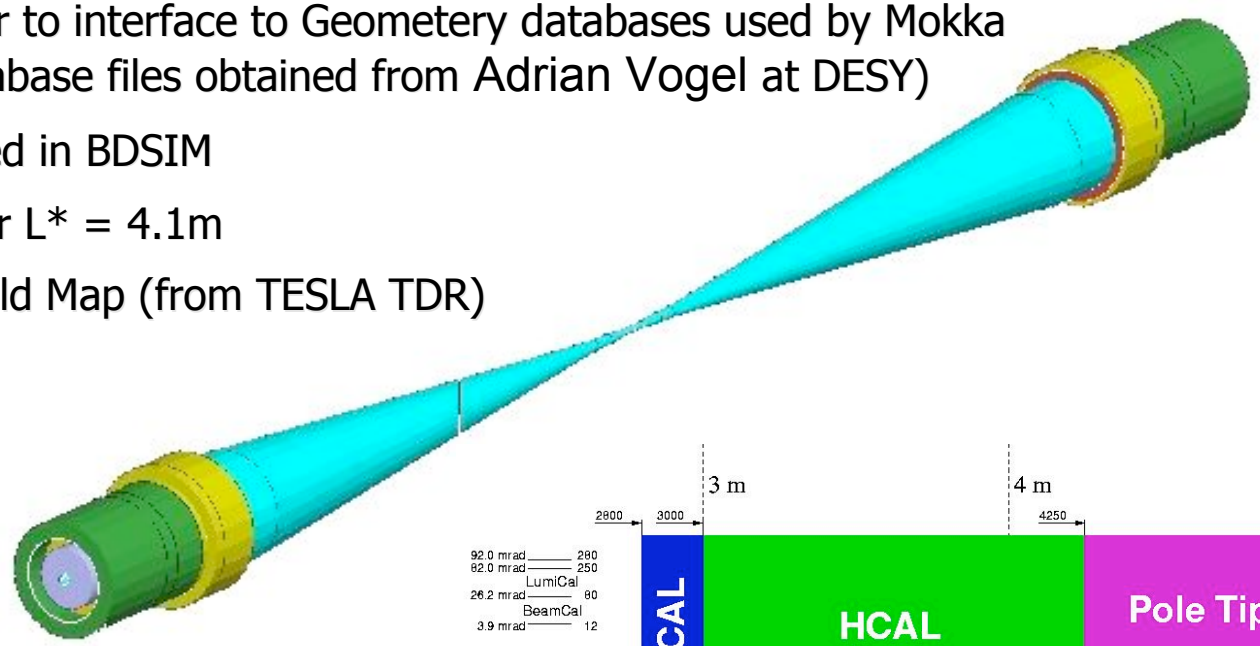
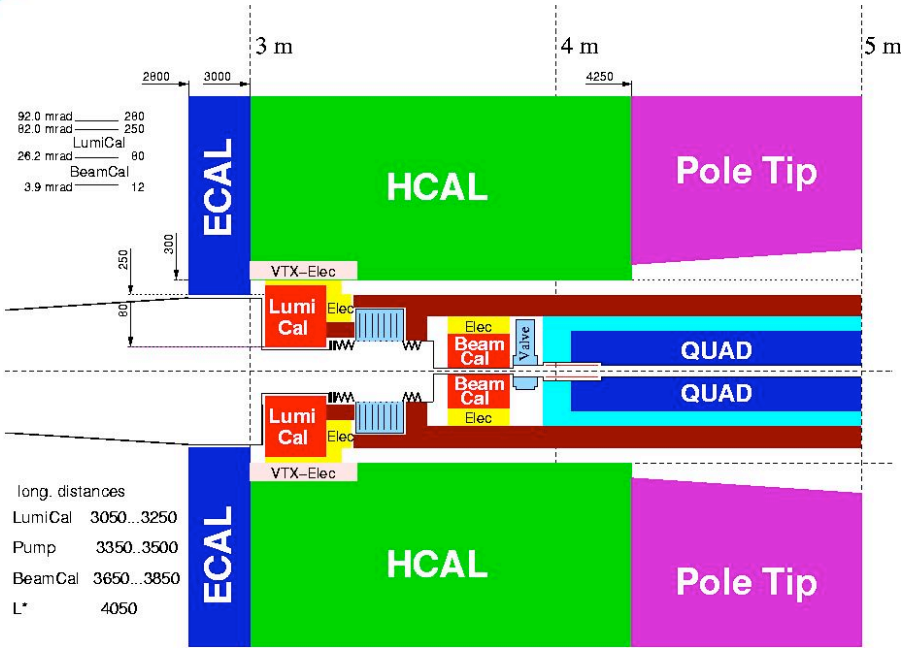
IR Geometry Set Up

- Written a MySQL wrapper to interface to Geometery databases used by Mokka (Using OFFLINE SQL database files obtained from Adrian Vogel at DESY)
- Full IR Geometry modelled in BDSIM
- Using the Stahl design for L* = 4.1m
- Including 4T Solenoid Field Map (from TESLA TDR)

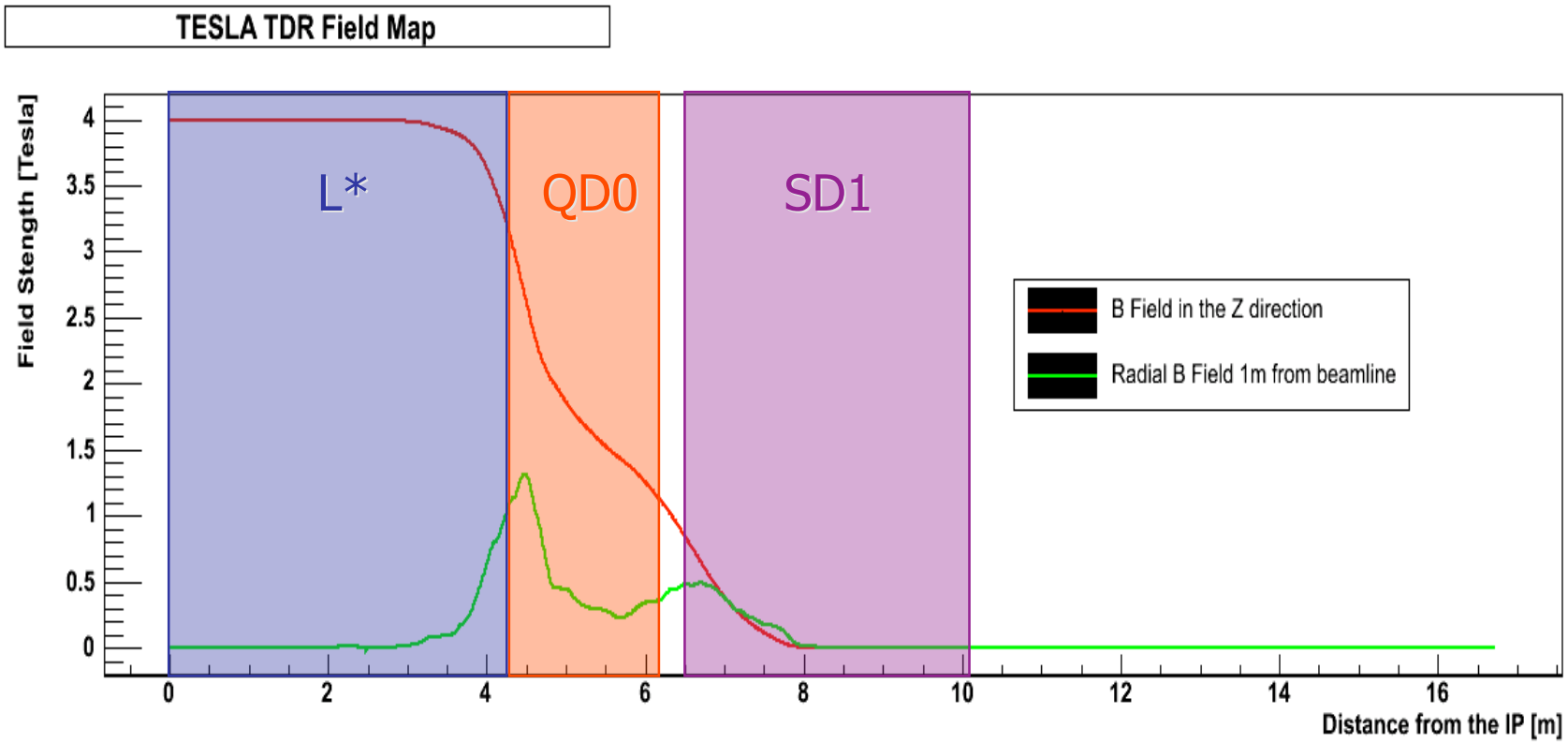




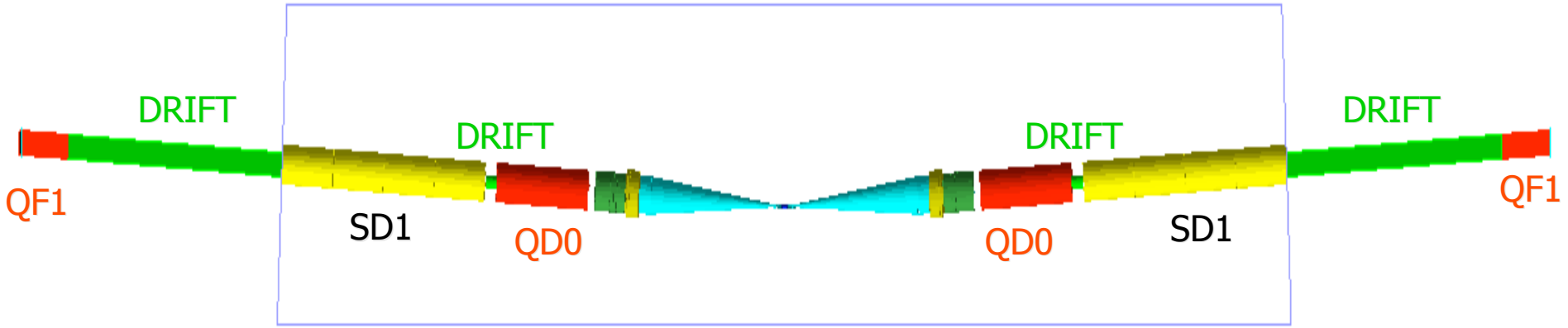


Field Maps

- Have defined the 'Interaction Region' in BDSIM to be region over which the Solenoid Field extends
- Have included the Quad and Sextupole Field in this region - currently implemented as a linear addition… correct coupling of fields to come next!



Short Doublet Set Up



All simulations run with the following:

Charged Particle Cut: 10 keV & Photon Cut: 1 keV

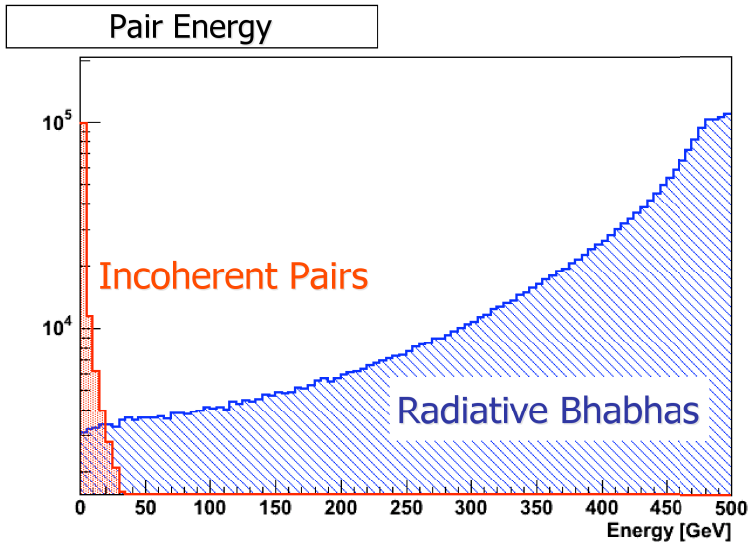
1.6mrad crossing angle

(over exaggerated for illustration purposes!)

	Strength	Pole tip Field Strength [T]	Length [m]	Aperture Radius [mm]
L*	-	4T Field Map	4.100	≥9
QD0	K1=-0.137	8.0	1.924	31
Drift1/3	-	-	0.250	31
SD1	K2=0.672	5.5	4.250	95
Drift2/4	-	-	4.500	95
QF1	K1=0.08394	1.4	1.015	10

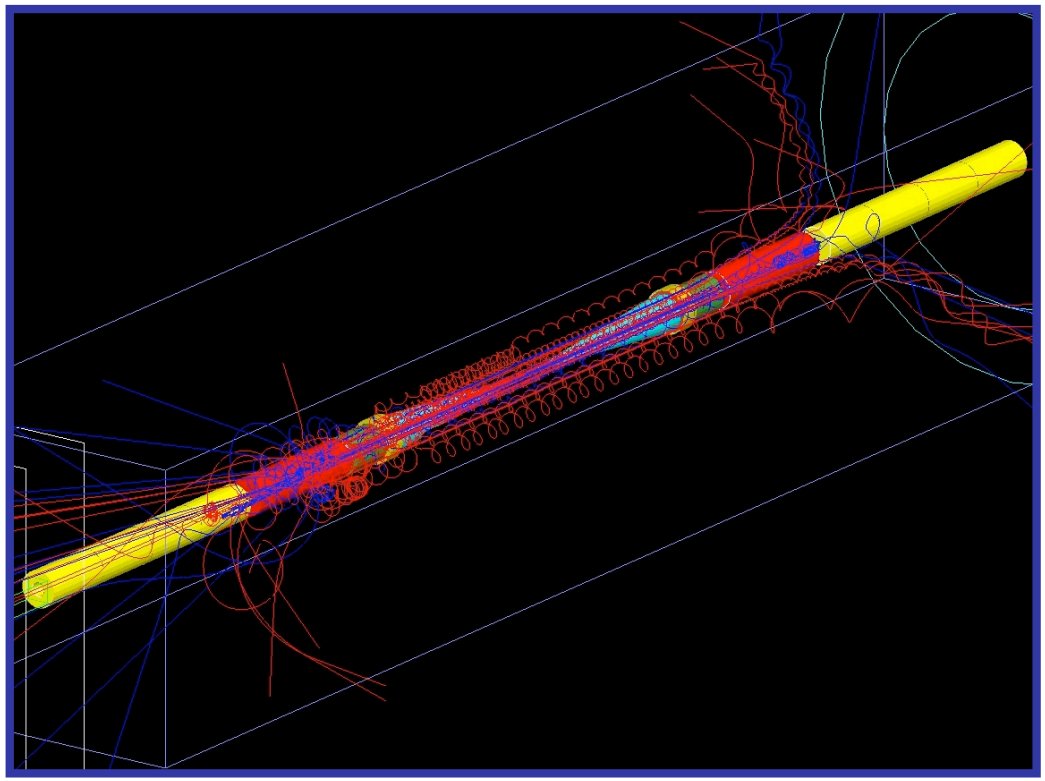
Pairs Backgrounds

- Started work on Pairs Backgrounds - improving geometry & added IR solenoid field map (TESLA TDR field)
- Using Guinea-Pig produced pairs for the ILC 1TeV machine.
  - Incoherent Pairs & Radiative Bhabhas based on WG1 TeV Nominal Parameters



50 Incoherent Pairs in the IR.
Interactions have been turned OFF so no showers, etc seen.

(red = e- ; blue = e+)

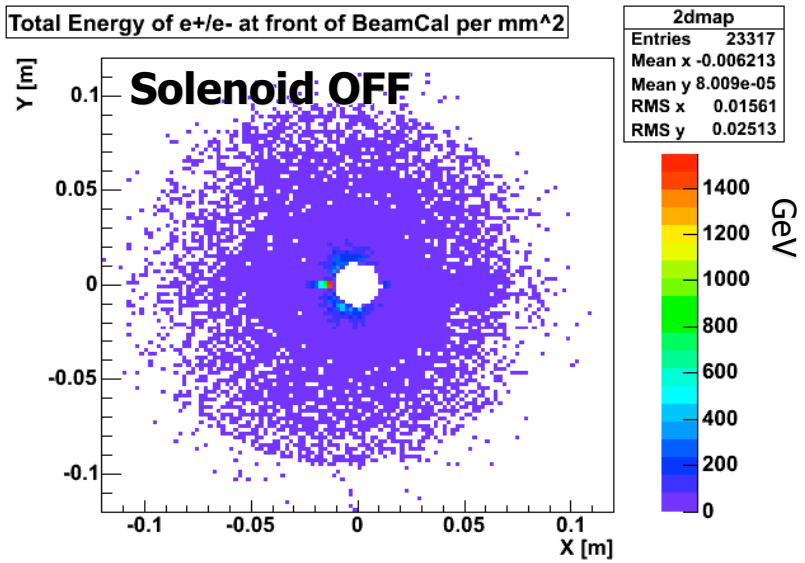


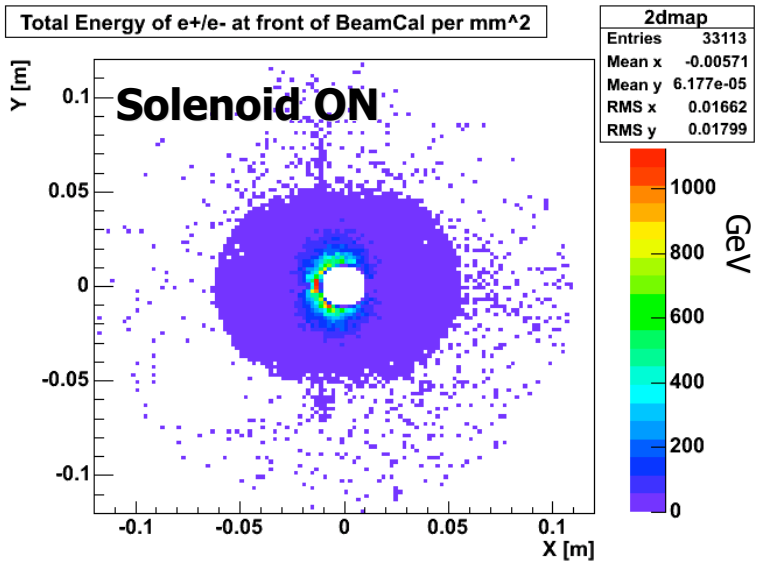
Incoherent Pairs

- Guinea-Pig file produced for WG1 TeV nominal parameters - one bunch crossing
  - N = 133642 <E> = 6.743 GeV
- Preliminary results - tracked with and without Solenoid Field.
- Beam pipe radius of the BeamCal = 12mm
- NO MASK IN PLACE

- Solenoid OFF:
  - Total Energy hitting face of BeamCal = 52600 GeV
- Solenoid ON:
  - Total Energy hitting face of BeamCal = 100,300 GeV

Twice as much energy than for NO solenoid!!



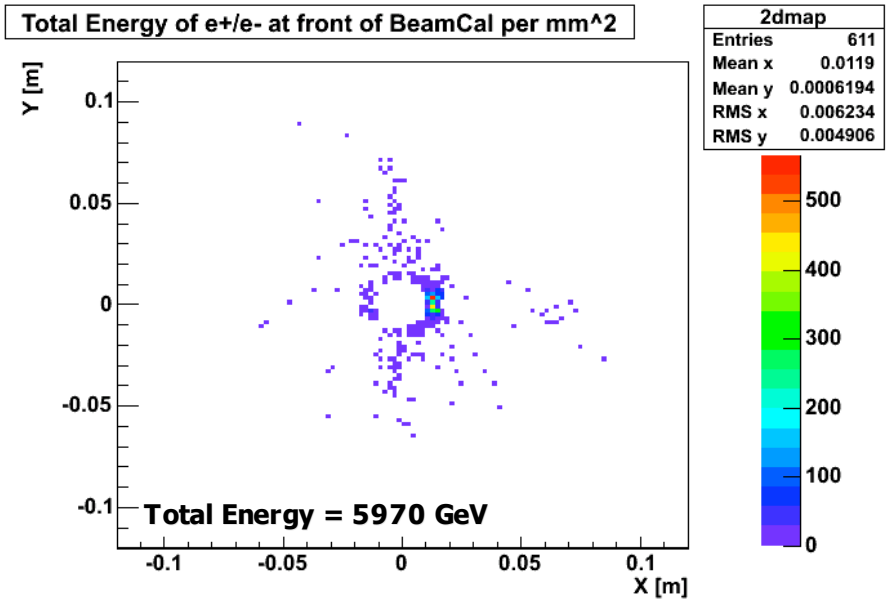


Radiative Bhabhas

- Guinea-Pig file produced for WG1 TeV nominal parameters - one bunch crossing
  - N = 1.86×10^6 <E> = 394.6 GeV
- Tracked with Solenoid Field & 1.6mrad Crossing Angle

  (solenoid 'off' to be done later - if needed)

- Energy Deposits into Components
  - QD0: 1.73W
  - SD1: 6.85W
- Comparable to other studies (T.Maruyama)
  - QD0: 1.9W
  - SD1: 0.1W

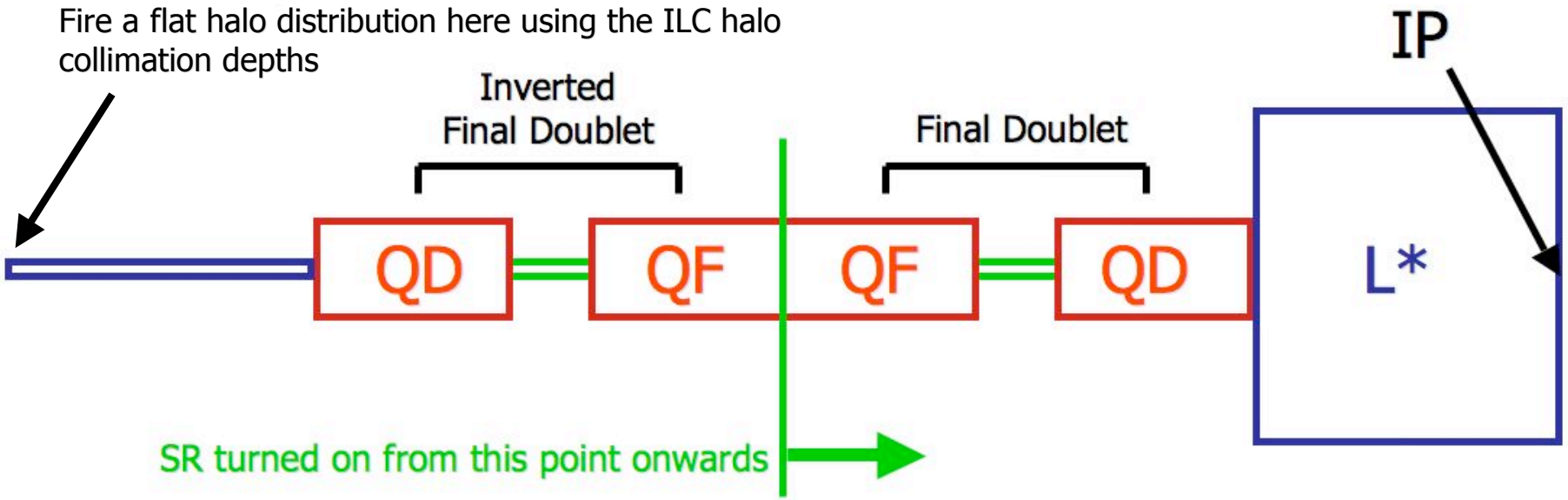


- Tracking down the extraction line proves to be difficult - due to large amount of showering when tracking down to 1keV…

Halo Generation

- Use BDSIM to trace back the halo profile needed at the final doublet in order to produce the ILC collimation depth requirements.
- Fire this profile back through the final doublet with synchrotron radiation processes turned on

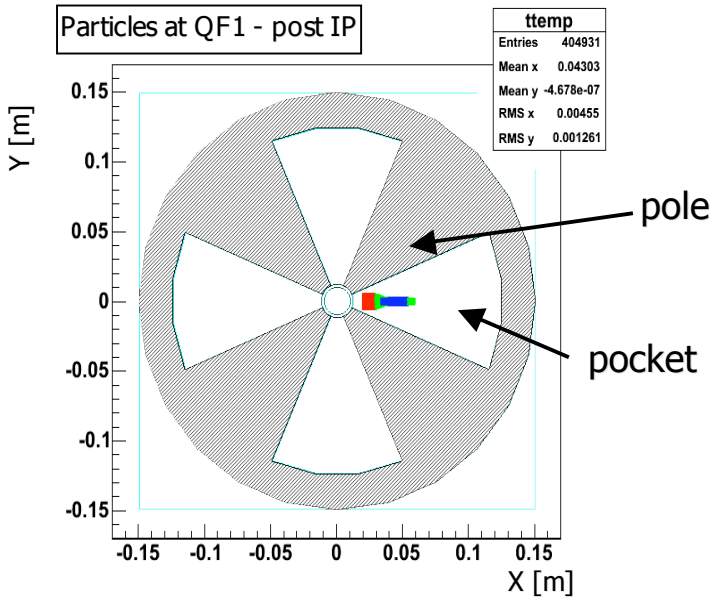
Can be done in one go using an inverted final doublet



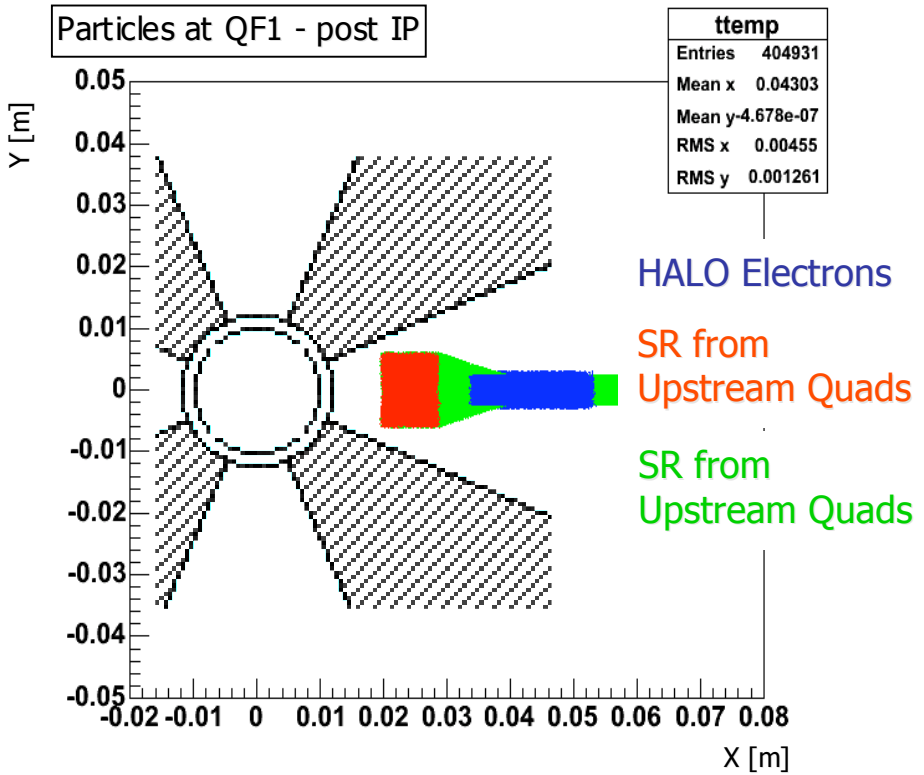
- Of course, BDSIM could have created the Halo distribution by tracking the electrons from the Linac down the entire Beam Delivery System.

Halo Collimation

- Synchrotron Radiation generated by the Halo in the final doublet quads provides the motivation for the collimation depth requirements.
- Would like to know how far this requirement can be stretched before the vertex detector reaches its upper limit on background hits: ~10 Hits/mm^2 - incident energy ~1-10 keV



All Halo related material passes QF1 with NO backshine to VXD



Conclusions and Outlook

- Several ongoing studies using BDSIM
  - Good tool for providing tracking and secondary production
  - Statistics only really limited by CPU time - use of computer farms on the Grid and at RHUL has significantly helped this!
  - Might be worth investing some time into optimising tracking for very low energy particles…
- VXD Hits Vs. Halo Collimation Depth studies are underway
- Extraction line backgrounds can be looked at in depth
  - But to do this an accurate physical description of elements is needed to produce Quads, Sextupoles. Sector Bends geometries based on realistic engineering diagrams.
  - Addition of full field maps in components is currently in progress (I. Agapov)