Results of BDSIM and capabilities of the tools

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- Introduction to BDSIM
- Current BDSIM Developments
- Tracking along Beam Delivery System (20mrad)
- Pairs in the Interaction Region
- Halo Collimation Depth Studies
- Future Plans
  - Extraction line backgrounds
  - 20mrad IR Set Up.

12th July 2005
SLAC - Weekly BDS meeting

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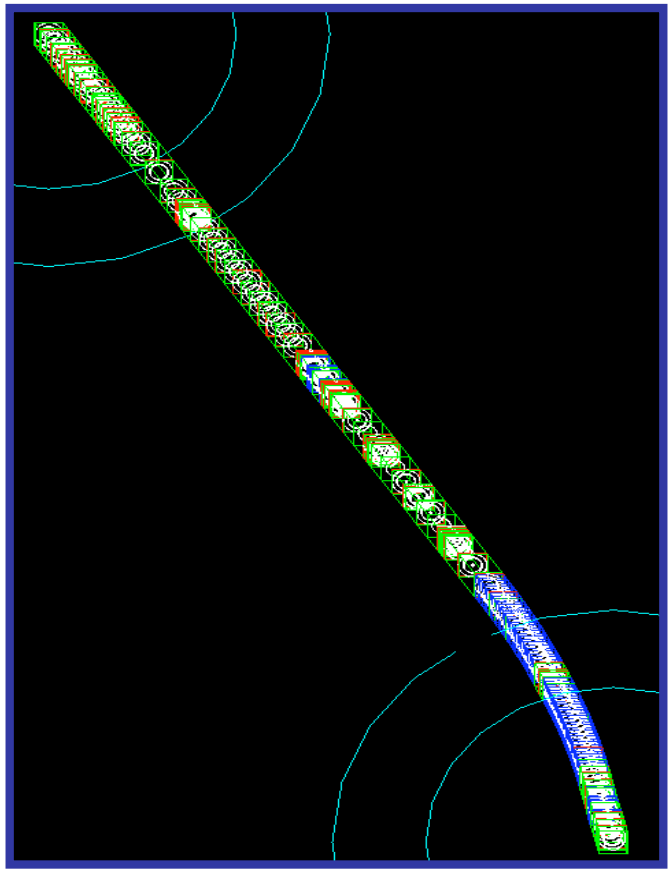
Introduction to BDSIM

- Author: G.Blair
- Maintainers/Developers: I. Agapov, J. Carter, and a new student (Sep 05)



20mrad BDS in BDSIM

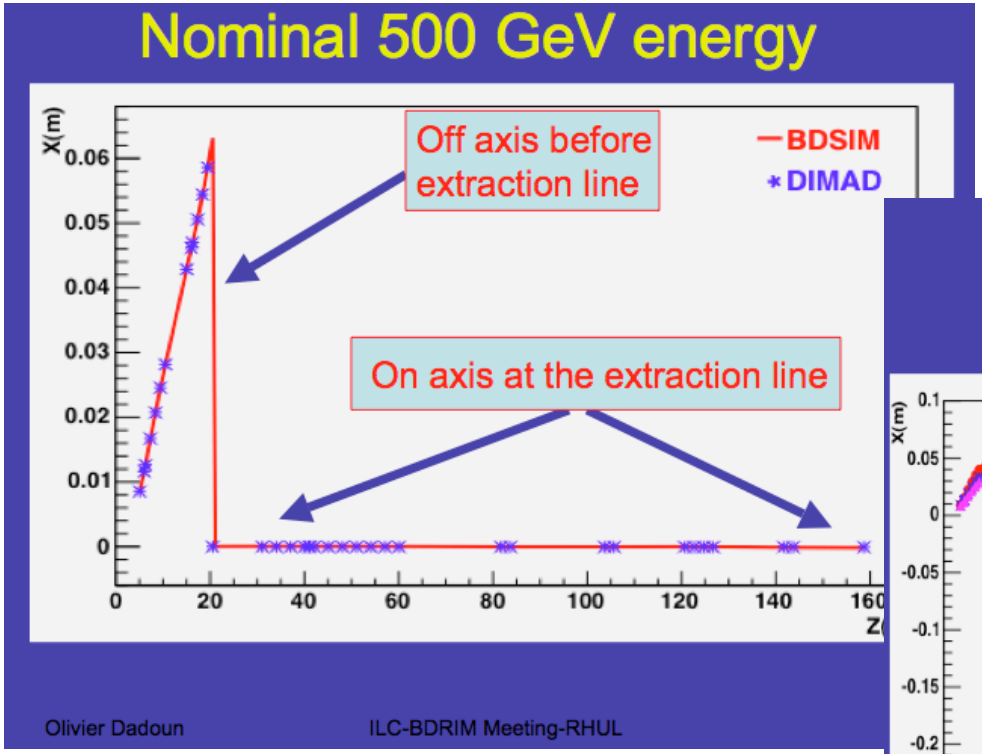
- BDSIM is a C++, Geant4 based toolkit providing
  - Fast tracking through accelerator components
  - All Physics Processes from Geant4
  - Any other processes, e.g.:
    - H. Burkhardt Synchrotron Routines
    - Neutron processes (implementation currently being investigated)
- Optics format output from MAD read into BDSIM
- Track Bunch/Halo particles
- Read in GuineaPig bunch files - e.g. Pairs, Disrupted…
- Collimation Studies
- Check background levels at any point along the beam line - useful for positioning and performance checks on beam diagnostic tools
  - Already used to improve signal at PETRA Laserwire installation

Current BDSIM Developments

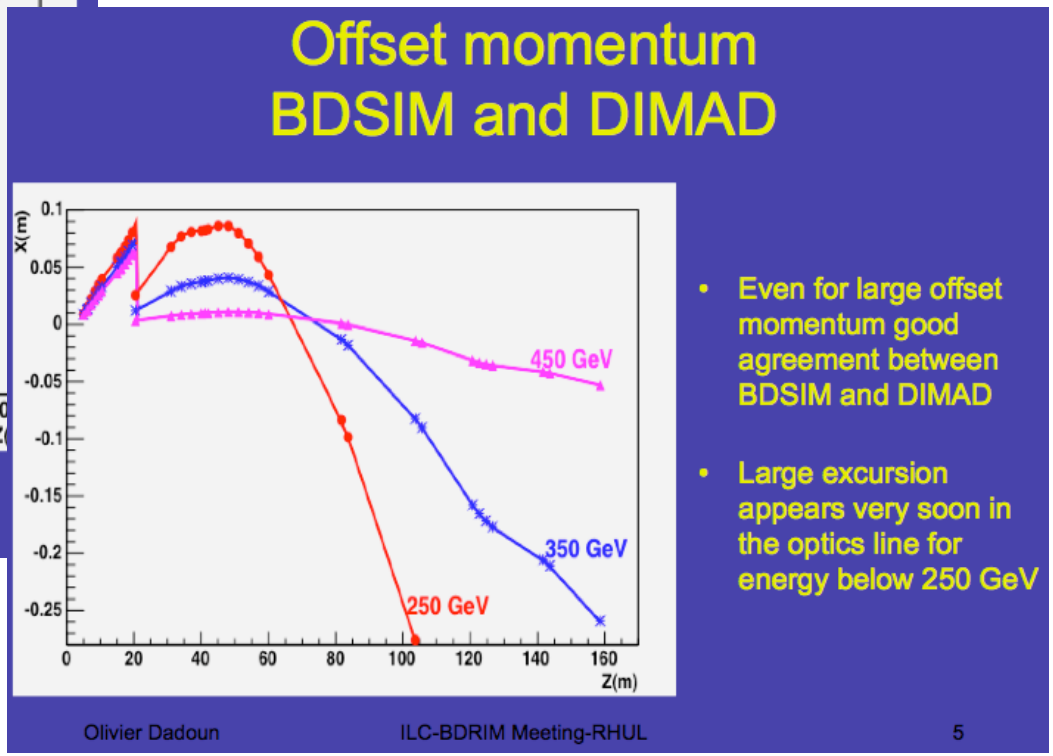
- Moving BDSIM to MAD-like input format
  - Read MAD decks directly - without the need to produce optics format files
  - Using MAD-like files to include process flags, geometries, bunch descriptions, etc.
- Complicated Geometries (e.g. Interaction Region) can be built using MySQL database
  - Links to detector studies that use Mokka
  - Removes need to hand code complicated geometries
  - Will be possible to apply to key/specialised components such as extraction quads
- Implement Neutron processes - we don't trust Geant4's!
- Looking to add sensible tracking cuts depending on regions of interest along the beam line
- Many other issues being looked at, such as beam gas

BDSIM Tracking

- BDSIM tracking has been checked against DIMAD for nominal and offset momentum - results match very closely (O.Dadoun, LAL)



Tracking done along the first 160m of the short doublet extraction line



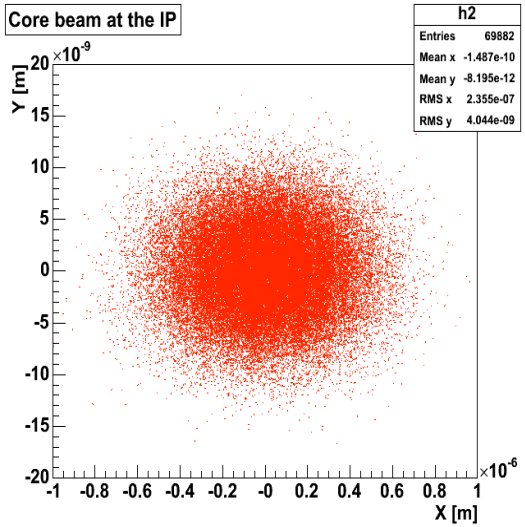
DIMAD / BDSIM Comparison talk given by O. Dadoun at ILC-BDIR June 2005

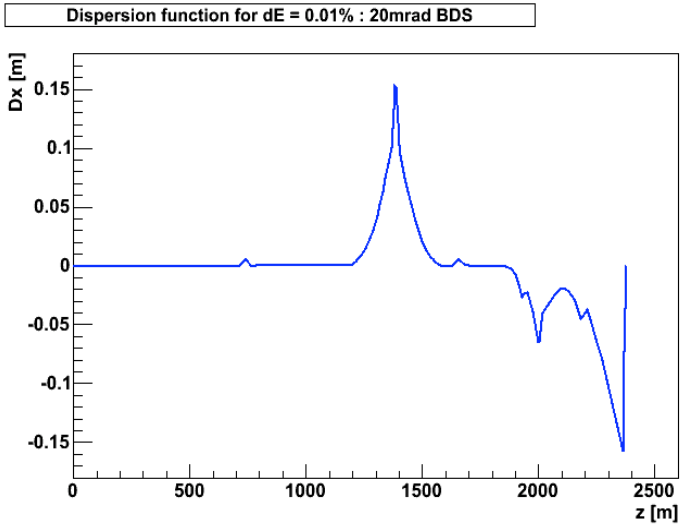
Full BDS Tracking

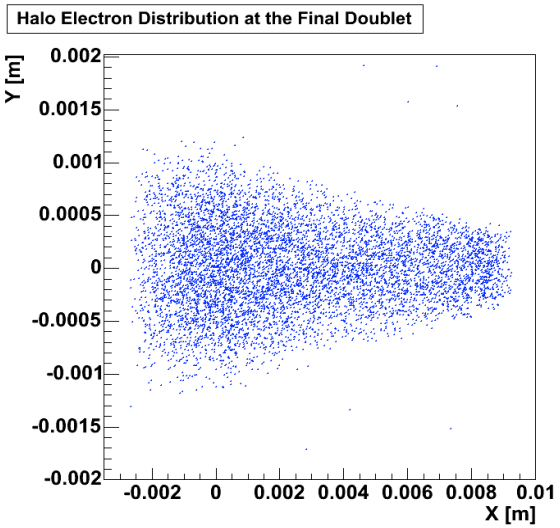
- Tracked core and halo particles along the 20mrad BDS from exit of linac to IP

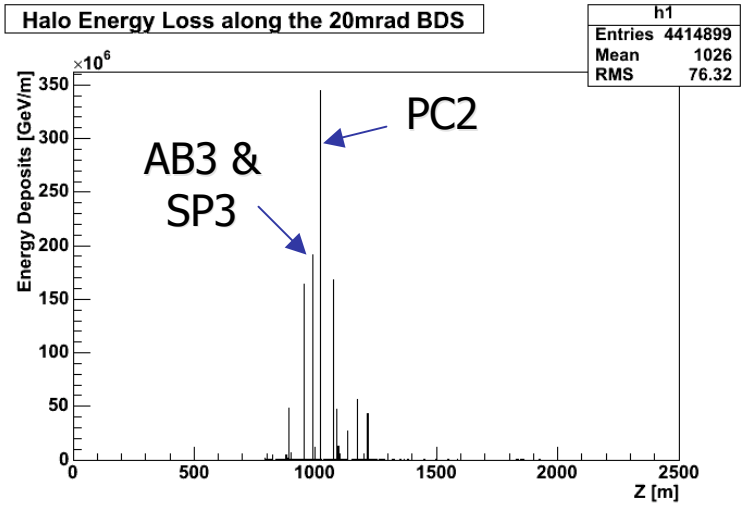
7x10^4 Core beam events fired.

1x10^6 Halo events fired. Only ~9x10^3 reach FD



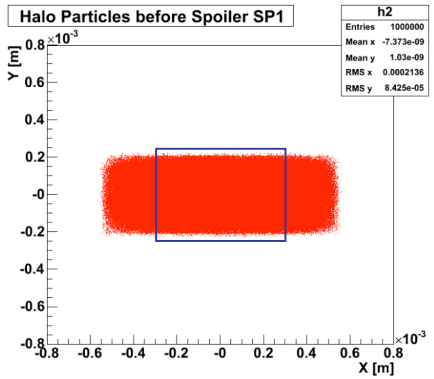


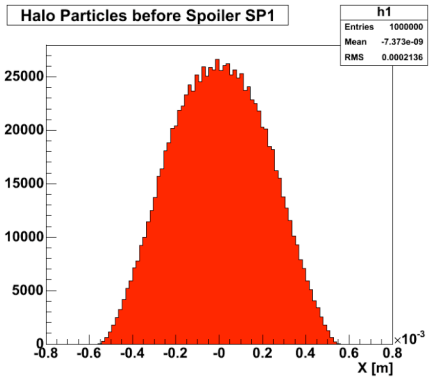


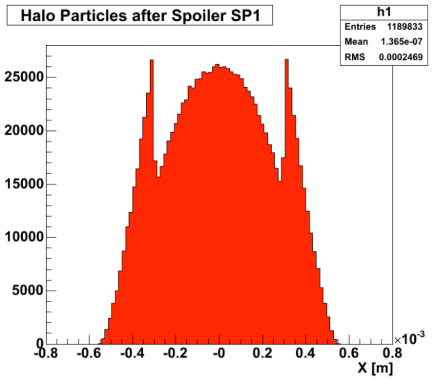


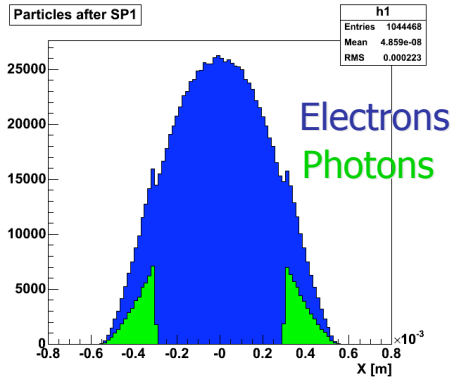
Full BDS Tracking

- Check collimation before and after spoilers: (all plots for Halo simulation)

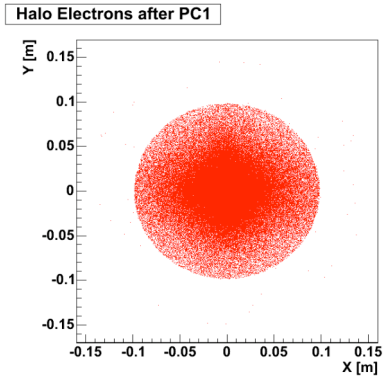


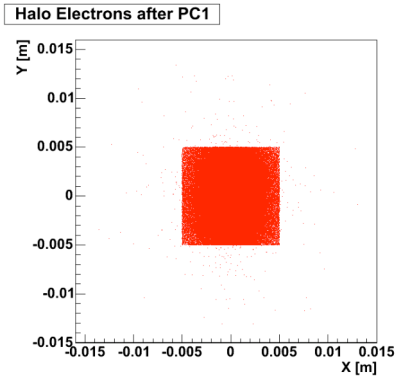


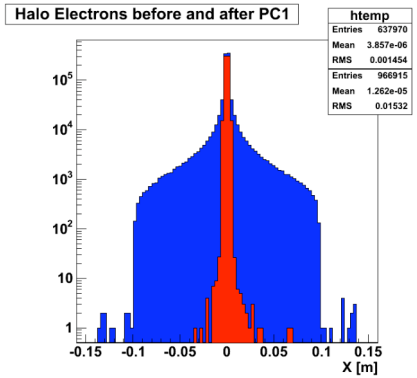


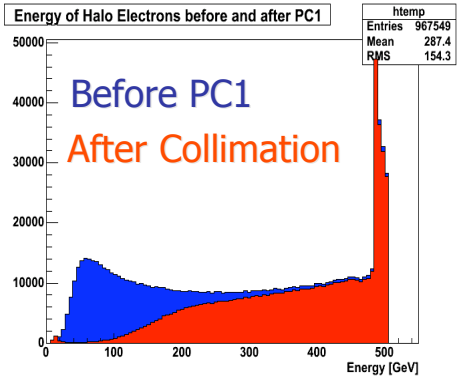


- Check energy collimation:







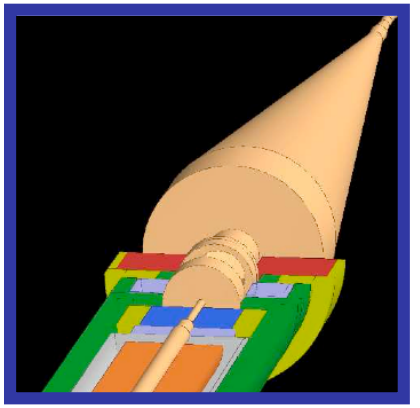


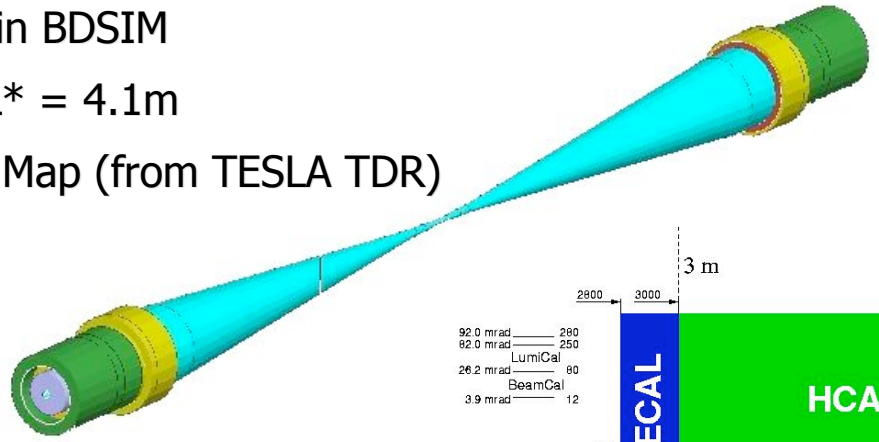
(E Cuts: 100 GeV for photons ,0.1 GeV for electrons. SR processes turned OFF)

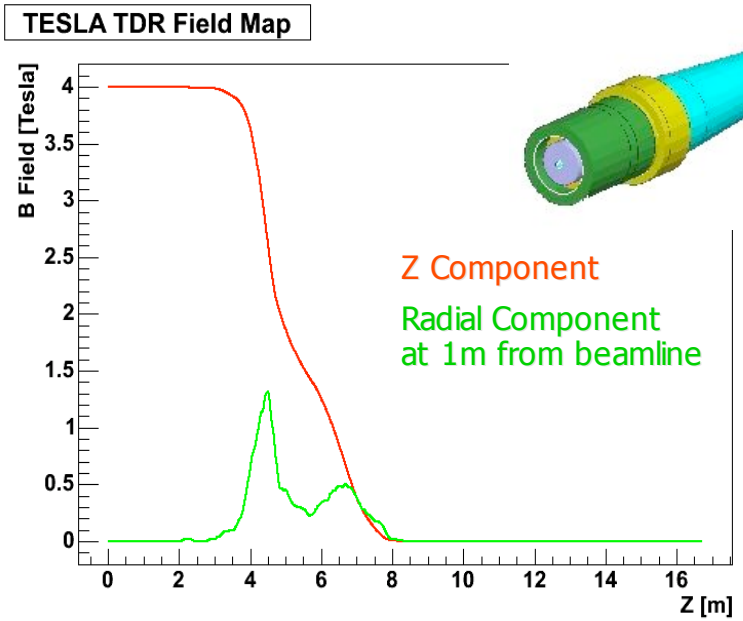
IR Geometry Set Up

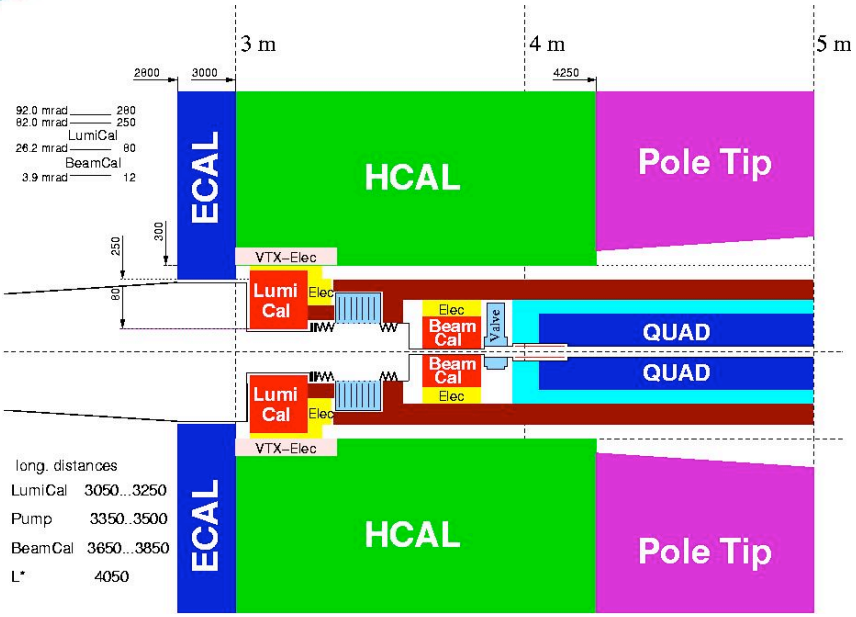
- Written a MySQL wrapper to interface to Geometry databases used by Mokka (Using OFFLINE SQL database dump file obtained from A. Vogel at DESY)
- Can also access a locally running MySQL database
- Full IR Geometry modelled in BDSIM
- Using the Stahl design for L* = 4.1m
- Including 4T Solenoid Field Map (from TESLA TDR)

A. Vogel, ILC-BDIR June 2005

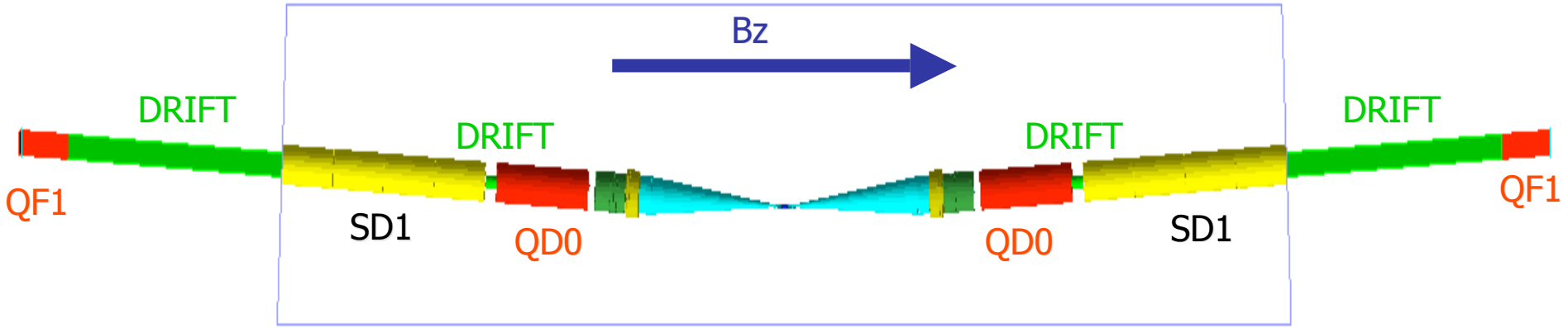








Short Doublet Set Up



All simulations run with the following:

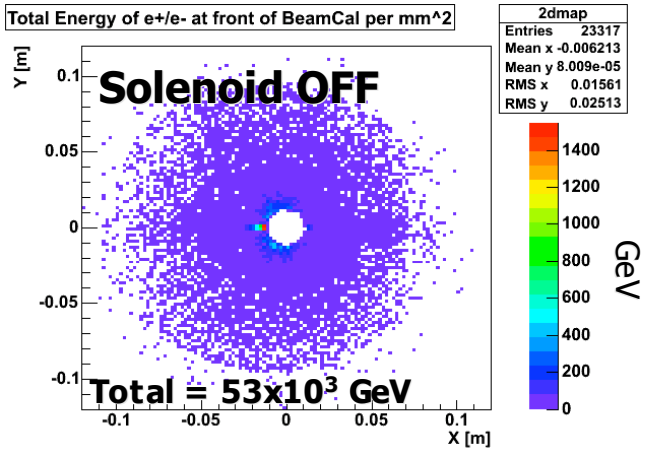
Charged Particle Cut: 10 keV & Photon Cut: 1 keV

1.6mrad crossing angle

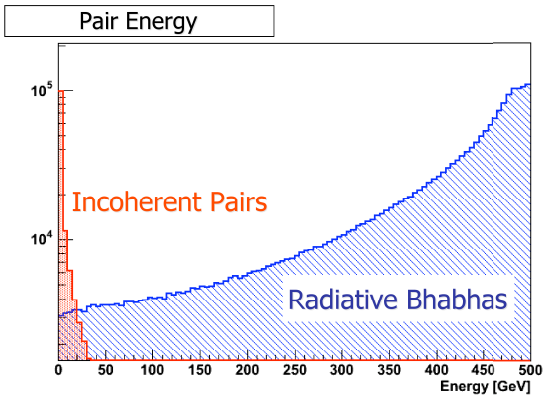
(over exaggerated for illustration purposes!)

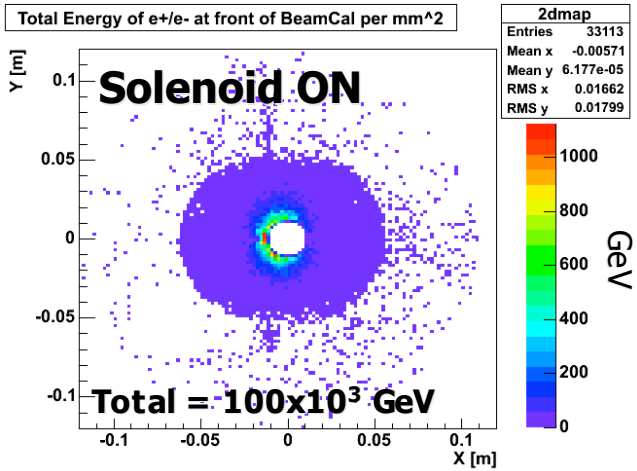
	Strength	Pole tip Field Strength [T]	Length [m]	Aperture Radius [mm]
L*	-	4T Field Map	4.100	≥12
QD0	K1=-0.137	8.0	1.924	70
Drift1/3	-	-	0.250	95
SD1	K2=0.672	5.5	4.250	95
Drift2/4	-	-	4.500	95
QF1	K1=0.08394	1.4	1.015	10

Pairs Backgrounds



- Using Guinea-Pig produced pairs based on the WG1 1TeV Nominal for 1bx
  - Incoherent Pairs
    - N = 133642
    - <E> = 6.743 GeV

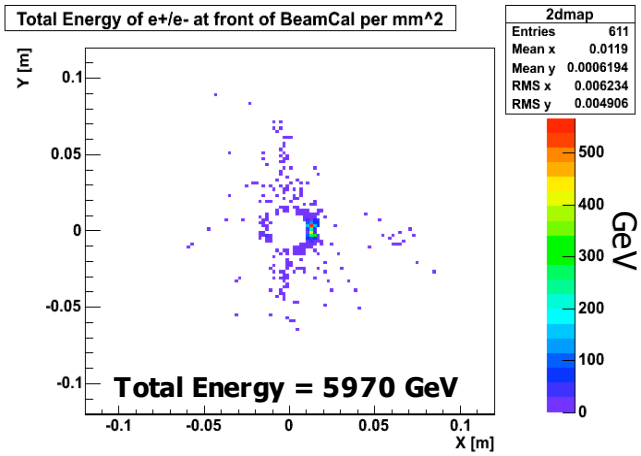




Twice as much energy than for NO solenoid!!

- Radiative Bhabhas
  - N = 1.86x10^6
  - <E> = 394.6 GeV
- Power into QD0 ~ 1.7W
- Power into SD1 ~ 6.9W
  - (to be checked…)

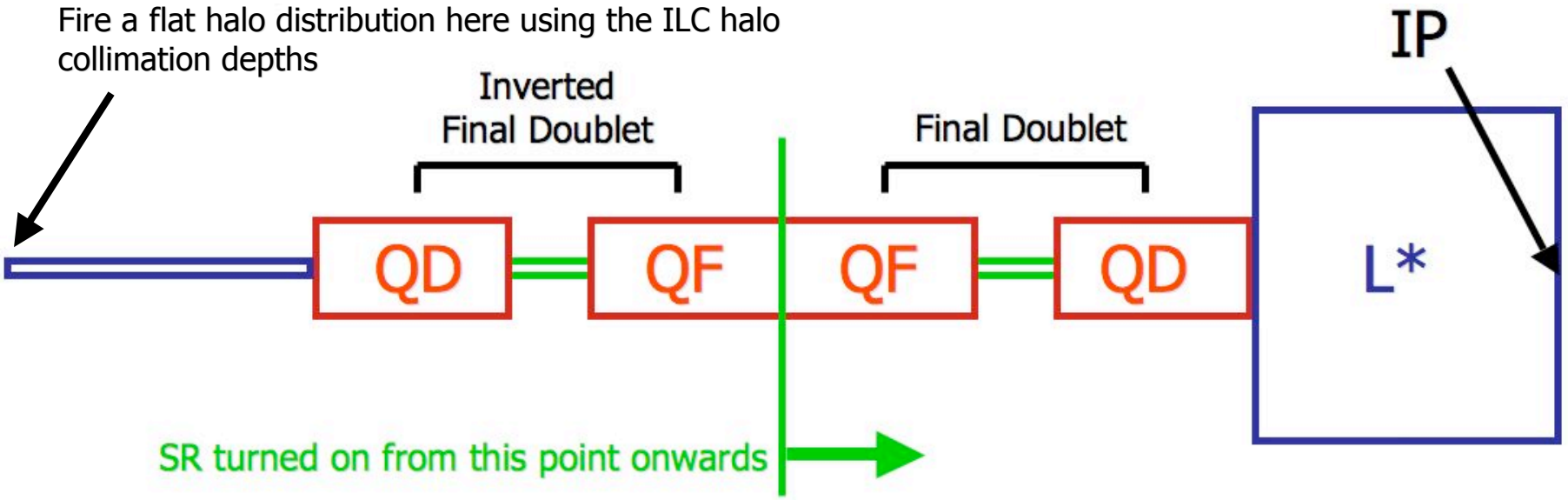
Note: No mask in place



Halo Generation at the IP

- 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



Conclusions and Outlook

- BDSIM
  - Good tool for providing tracking and secondary production
  - Next release of BDSIM planned in the near future
- Collimation Issues currently being investigated
- Look at both Long and Short doublets?
- Extraction line backgrounds can be looked at in depth
  - Need to introduce some optimised energy cut and shower propagation methods
  - Full field maps can be implemented
- 20mrad IR set up being implemented
- Open to suggestions for any other studies needed….