SuperB: DCH Update on FullSim Bkg Studies

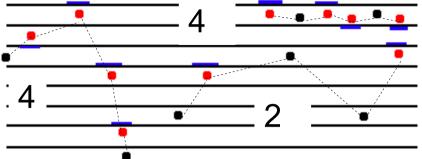
Dana Lindemann McGill University

SuperB Workshop - DCH Session April 4, 2011

Overview

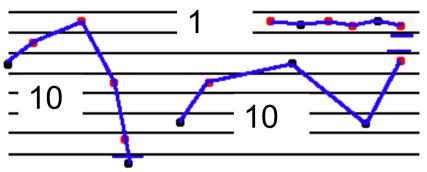
Latest "CIPE" Production samples:
 Comparison with older samples and step-size

Occupancy Algorithm



Deposited Energy w/o double-counting:

- •1 wire-hit for each hit with deposited E >0
- Uses whichever wire is closest to hit (accounting for phi arrangement)
- •Allows only 1 wire-hit per wire per event.
- Does NOT account for stereo wires
- Current "bug": if hit is closer to boundary than first or last wires, does not count in occupancy
- Doesn't work as well for larger step sizes
- My Bruno occupancies are normalized to ~215 Mhz
- Wire layout is same as Riccardo uses:
 First superlayer has smaller cell radii



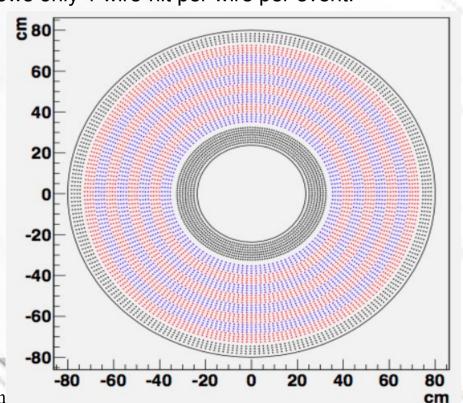
Hit-by-Hit w/o d-c : old method, not used anymore!

Straight lines between ALL hits

1 wire-hit per crossed wire

If no crossed wires, wire closest to first hit.

Allows only 1 wire-hit per wire per event.



New Vs. Old Prod. Geometries

Hit positions of all generated Bhabha primaries - old Geom

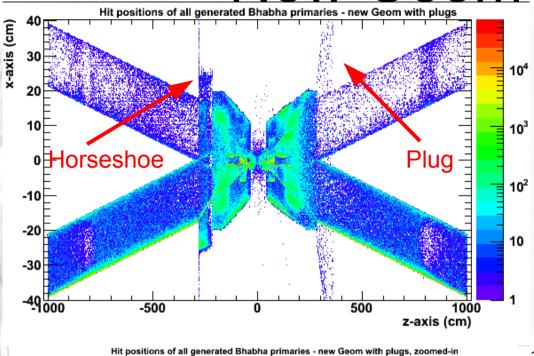
Beam pipes not modelled

Beam pipes not modelled

Beam pipes not modelled

Beam pipes not modelled x-axis (cm) x-axis (cm past the shield in the old geom! 10⁴ 10^{3} 10⁴ 10² -10 -20 10 Plots show all vertices where a primary = -30 outgoing Bhabha produces a daughter particle -49₀₀₀ -500 500 1000 z-axis (cm) z-axis (cm) Hit positions of all generated Bhabha primaries - new Geom, zoomed-in Hit positions of all generated Bhabha primaries - old Geom, zoomed-in 10⁴ 10⁴ 10³ 10^{2} 10² -15 300 -300-200 -300 -200 -100 100 200 300 z-axis (cm) z-axis (cm) Shield is shorter Dana Lindemann - McGill 04/04/11

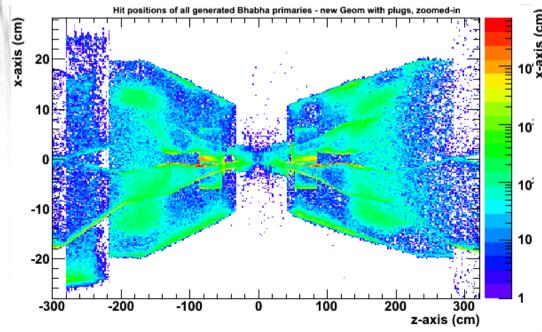
New Geom with Plugs - Extended tungsten shield

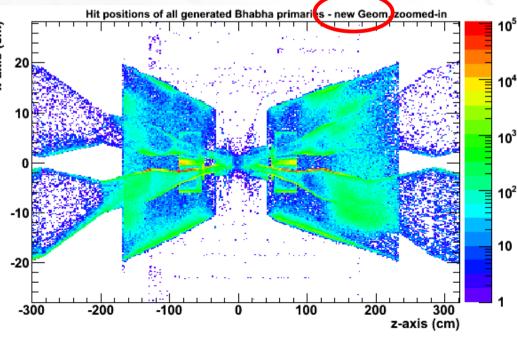


- Fwd plug and Bwd Horseshoe
- New FTOF model
- Trimmed back DCH (5cm in forward region)

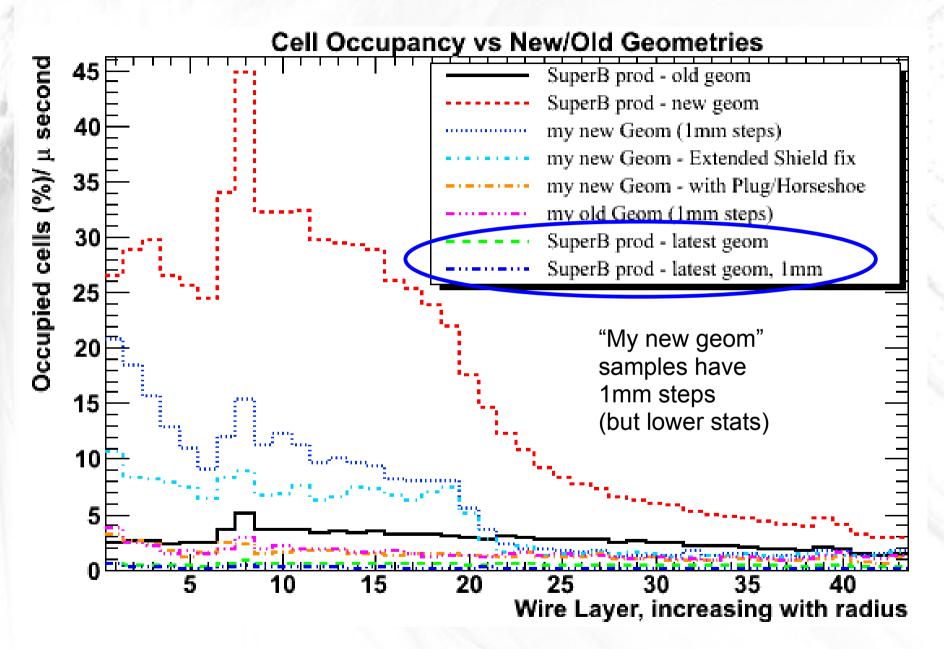
<u>Latest "CIPE" geometry (not shown here!)</u>

- More realistic Final Focus model using Sullivan's designs, extended to 16m
- Bending magnets after 8m (two bends)
- IFR electronics, improved IFR volume shape, rough model of EMC added
- Model of detector hall, made of concrete & instrumented with silicon layers

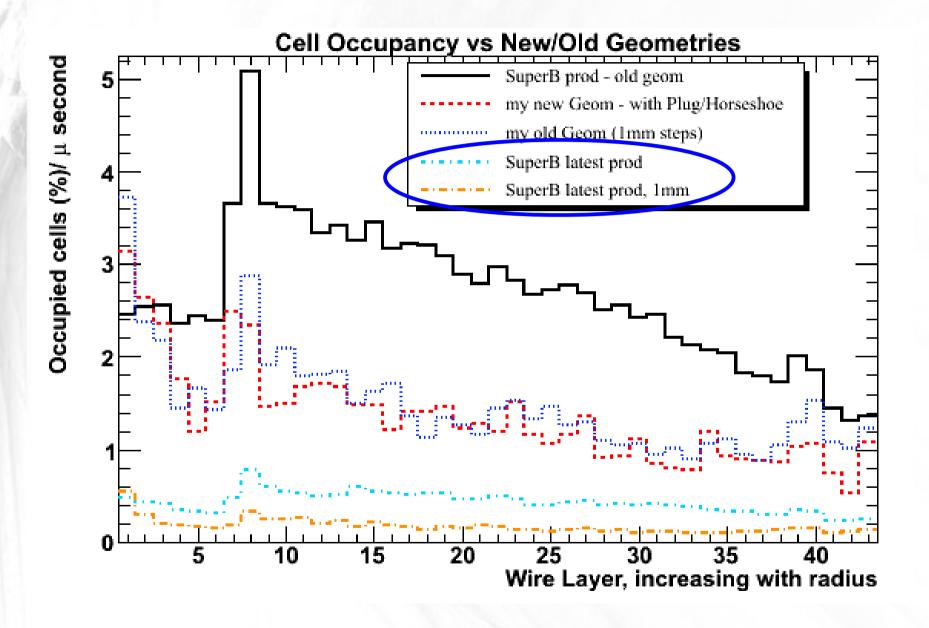




Comparison of Samples (Bruno only)



Comparison of Samples (Bruno only)



Latest "CIPE" Geometry Cell Occupancy vs. Energy - SuperB latest prod, 1mm Cell Occupancy vs. Energy - SuperB latest prod ≥4 GeV L5-4 GeV 1.5-4 GeV 0.15-1.5 GeV 15-150 MeV 1.5-15 MeV Occupied cells (%)/ µ 1.6 0.6-1.5 MeV 0.6-1.5 MeV <0.6 MeV <0.6 MeV 1 bit Tracks 1 hit Tracks Occupied 0.8 0.8 0.6 0.60.4 0.2 0.2 30 20 30 10 15 35 Wire Layer, increasing with radius Wire Layer, increasing with radius Cell Occupancy vs. Energy (old geom (1mm stepsize) Cell Occupancy vs. Energy - new geom with plugs Occupied cells (%)/ μ second Occupied cells (%)/ μ second 1.5-4 GeV 1.5-4 GeV 0.15-1.5 GeV 15-150 MeV <0.6 MeV 0.6-1.5 MeV I hit Tracks <0.6 MeV

Note: Due to splitting plots into stacked colored "bins", it's possible for 2 tracks from same event to double count on a wire, resulting in falsely higher occupancies.

30

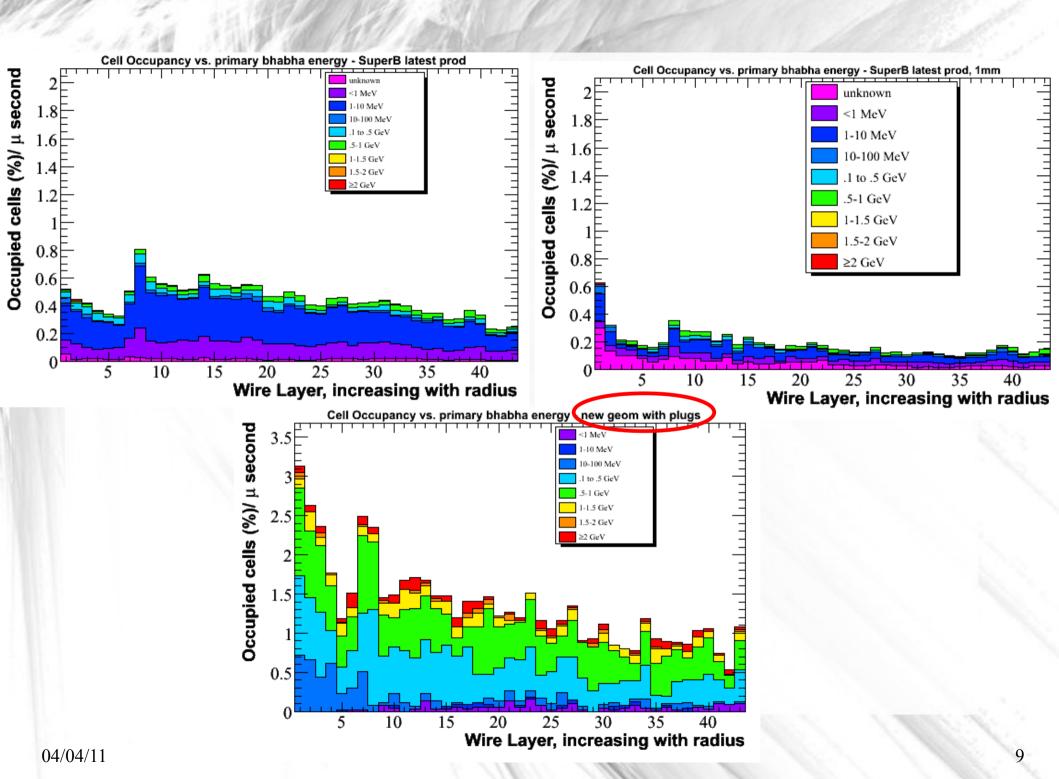
Wire Layer, increasing with radius

20

10

35

Wire Layer, increasing with radius



Track-causing Bhabha primaries - new Geom

Hit positions of Track-causing Bhabha primaries - new Geom

Track's parent must be outside DCH. (E) If it is not, I use grandparent, or great- grandparent, et 25 20 10 10 9000 -500 500 1000 -500 500 1000 z-axis (cm) z-axis (cm) Origin of Track's Parent(+) vs. Z - new Geom longer shield Hit positions of Track-causing Bhabha primaries - new Geom longer shield 10² with extended shield 20 20 500 -500 500 1000 z-axis (cm) z-axis (cm) Trouble area is gone with longer shield! Dana Lindemann - McGill 04/04/11 10

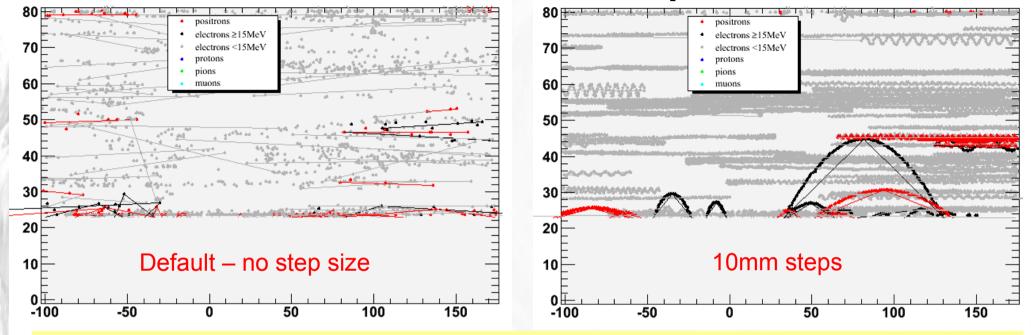
Track-producing Bhabhas/parents (II) Hit positions of Track-causing Bhabha primaries - new Geom Origin of Track's Parent(+) vs. Z - new Geom Origin of Track's Parent(+) vs. Z - new Geom 10 සි Track's parent must be outside DCH. If it is not, I use grandparent, or great- grandparent, et 10 9000 9000 -500 500 1000 -500 500 1000 z-axis (cm) z-axis (cm) Hit positions of Track-causing Bhabha primaries - new Geom with plugs Origin of Track's Parent(+) vs. Z - new Geom with plugs New Geometry with plugs 15 9000 -500 500 1000 z-axis (cm) -500 z-axis (cm)

Conclusions

- New Final Focus design shows great improvement in occupancy – almost half!
- More studies necessary, using Truth info, to understand exactly why...

Back-up Slides

Visualization of Step Sizes



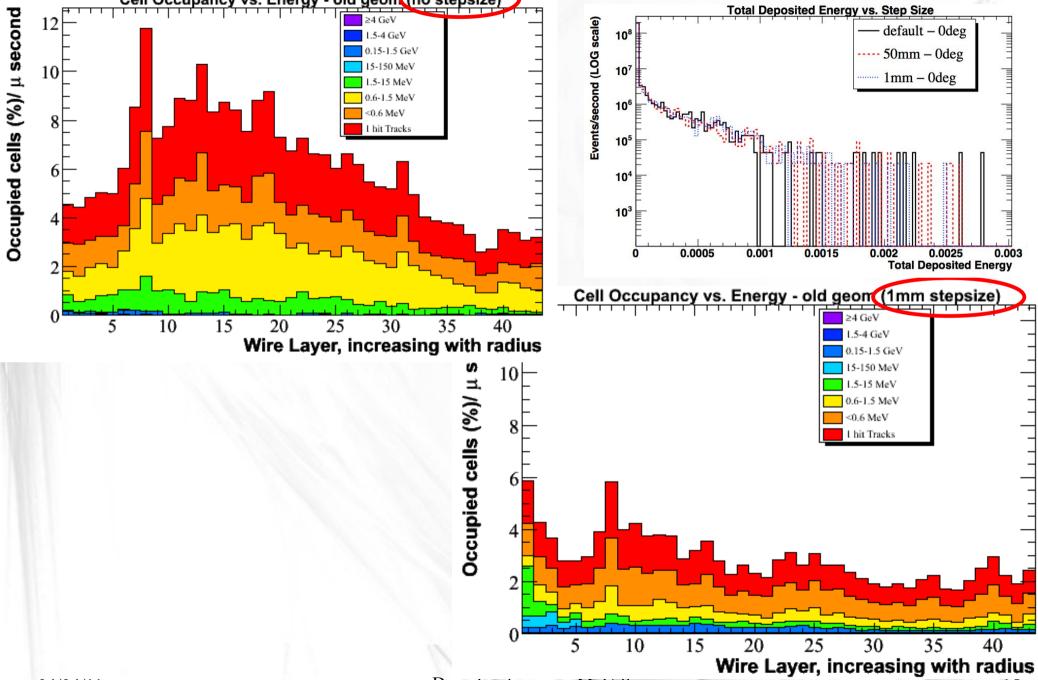
Same 200 events (>5deg) with tracks 1.5MeV < E < 150MeV, hits with deposited E > 0 only

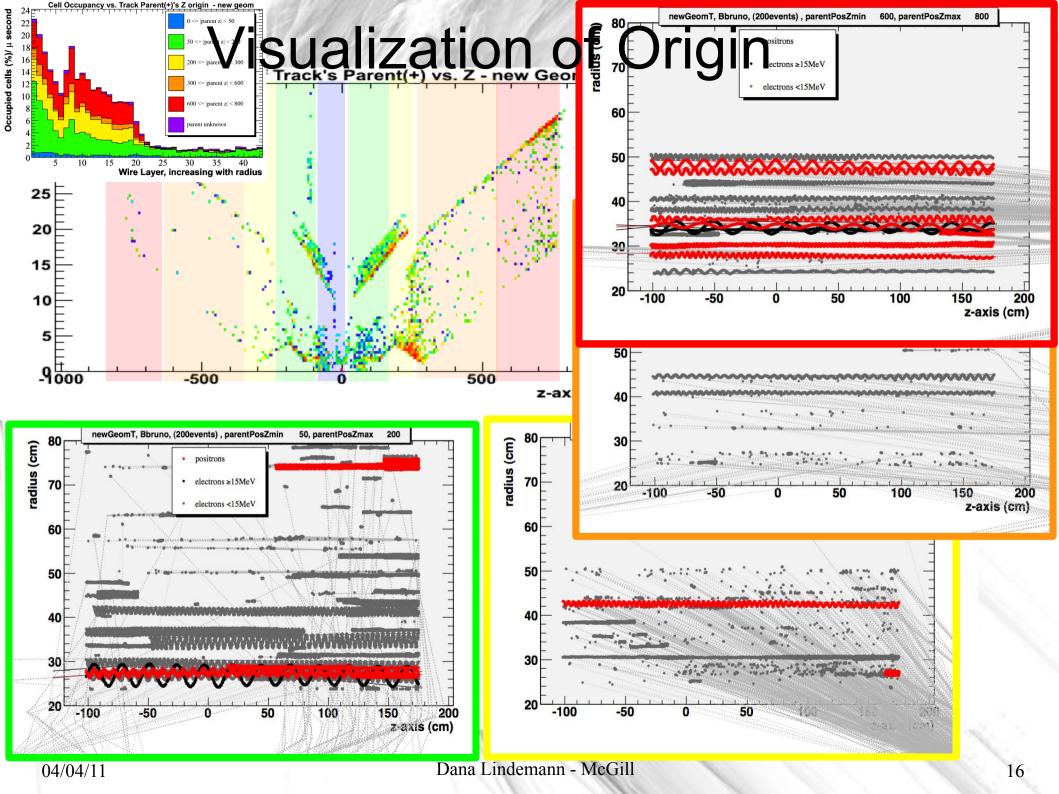
New occupancy method:

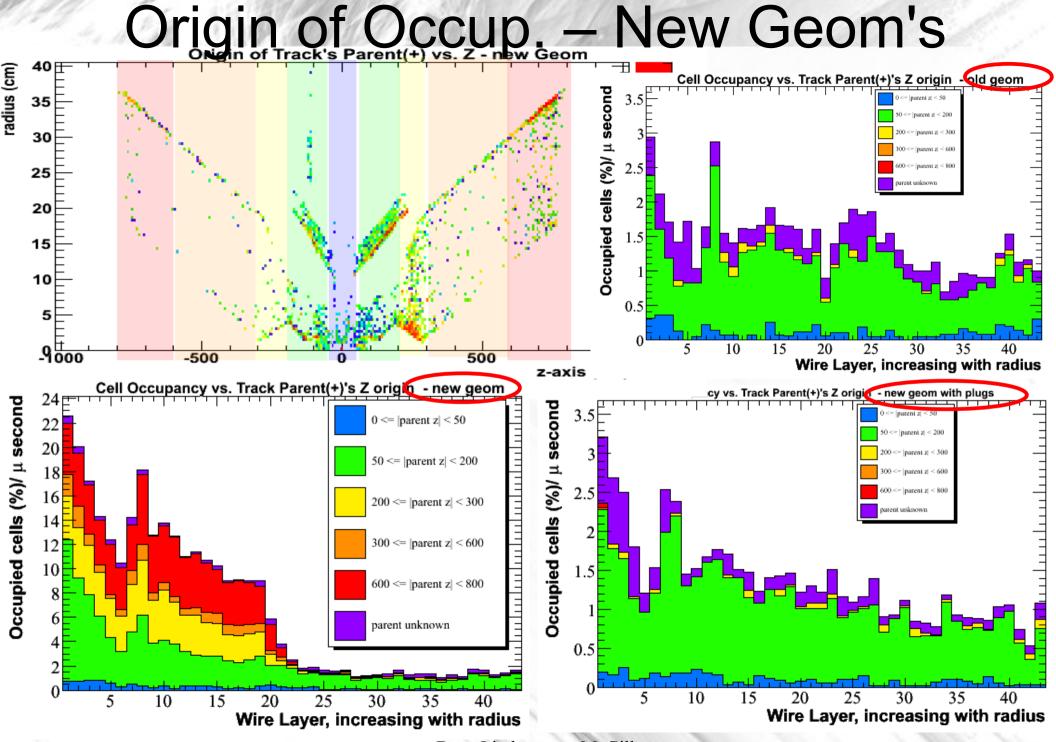
With smaller step-sizes (1mm Bruno & 10mm Bhwide), each instance of deposited energy counts as one "hit" on whichever wire is closest (axial wires only). Only one hit/wire/event is allowed.

Step Size vs. Occupancy (old geom)

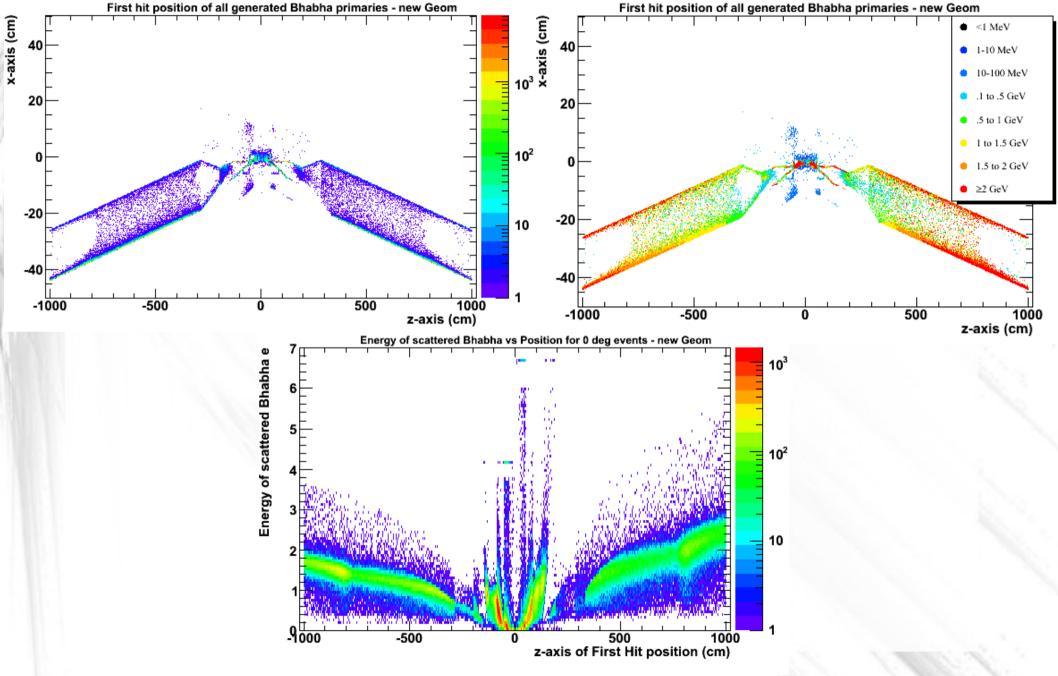
Cell Occupancy vs. Energy - old geom (no stepsize)







Where Bhabhas First hit the pipe



Occupancy vs. Bhabha energy

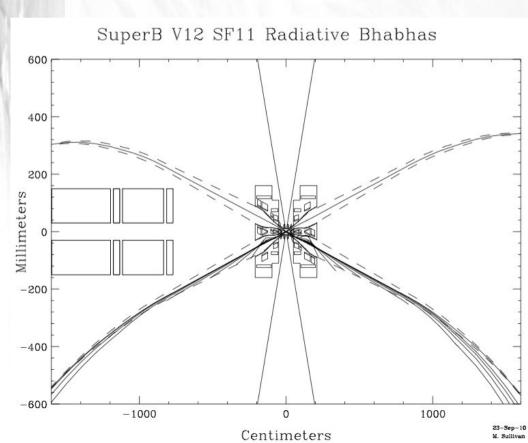
First hit position of all generated Bhabha primaries new - <1 MeV

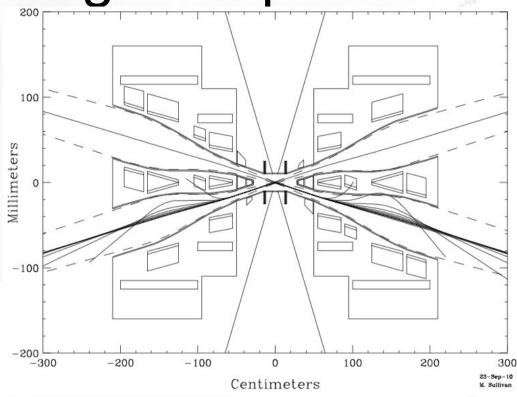
Cell Occupancy vs. primary bhabha energy Cell Occupancy vs. primary bhabha energy - old geom x-axis (cm) Occupied cells (%)/ μ second • 1-10 MeV 1-10 MeV 30 10-100 MeV 10-100 MeV I to .5 GeV .1 to 1 GeV .5-1 GeV .5-1 GeV 1-1.5 GeV 2.5 1.5-2 GeV 10 • 1-1.5 GeV ≥2 GeV • 1.5-2 GeV 0 ≥2 GeV -10 -20 -30 -4<u>9</u>00 -600 -400 -200 200 400 600 800 30 z-axis (cm) Wire Layer, increasing with radius Cell Occupancy vs. primary bhabha energy - new geom Cell Occupancy vs. primary bhabha energy - new geom with plugs Occupied cells (%)/ μ second <1 MeV second 20 $1-10~{
m MeV}$ 1-10 MeV 10-100 MeV 18 10-100 MeV .l to .5 GeV .5-1 GeV 16 I to .5 GeV <u>%</u> 1-1.5 GeV 1.5-2 GeV 5-1 GeV 14 ≥2 GeV cells 1-1.5 GeV 12 1.5-2 GeV 10 Occupied €.51 ≥2 GeV 8 0.5 15 20 30 35 40 20 25 35 40 10 15 30 10 Wire Layer, increasing with radius Wire Layer, increasing with radius

Mike Sullivan's Magbend plots

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Plot show 0.5-4 GeV in 0.5 increments





Magbend + My plots
First hit position of all generated Bhabha primaries - new Geom

