SuperB: DCH rates from Radiative Bhabhas in the latest Simulation

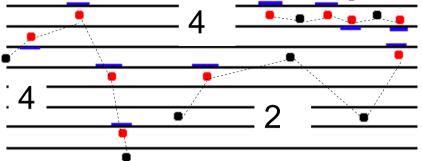
Dana Lindemann McGill University

SuperB Workshop - Backgrounds Session April 5, 2011

Overview

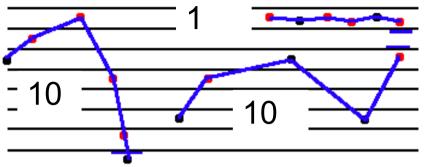
Latest "CIPE" Production samples:
 Comparison with older samples and step-size

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



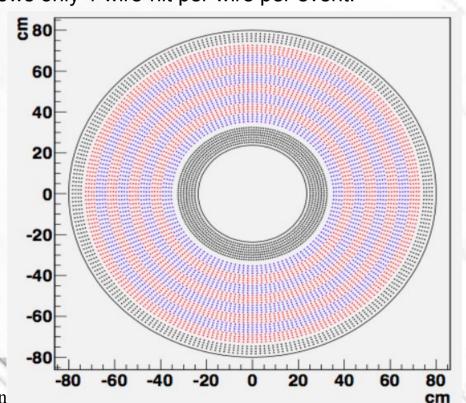
Hit-by-Hit w/o d-c : old method, not used anymore!

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

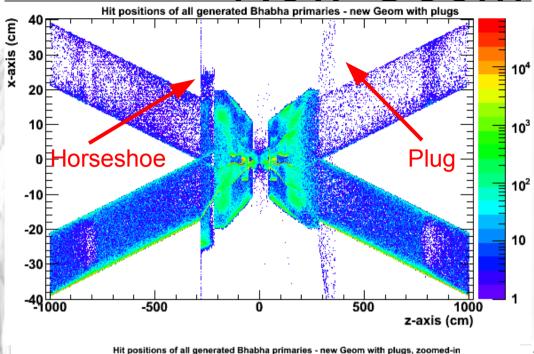
Hit positions of all generated Bhabha primaries - old Geom

Beam pipes not modelled

Beam pipes not modelled

Beam pipes not modelled x-axis (cm) x-axis (cm past the shield in the old geom! 10⁴ 20 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 10⁴ 10⁴ 10³ 10² 10² -15 300 -300-200 -300 -200 -100 100 200 300 z-axis (cm) z-axis (cm) Shield is shorter Dana Lindemann - McGill Apr 5, 2011

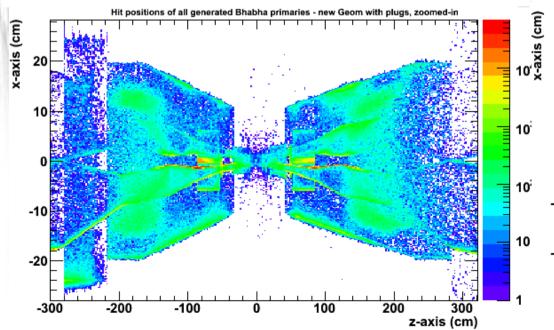
New Geom with Plugs

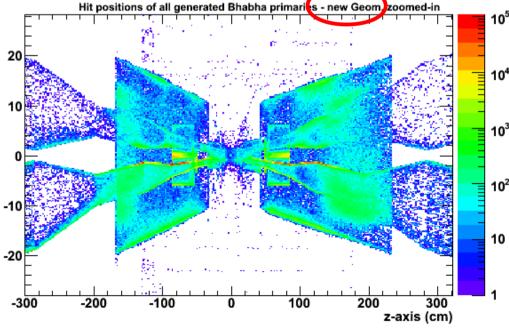


- Extended tungsten shield
- Fwd plug and Bwd Horseshoe
- New FTOF model
- Trimmed back DCH (5cm in forward region)

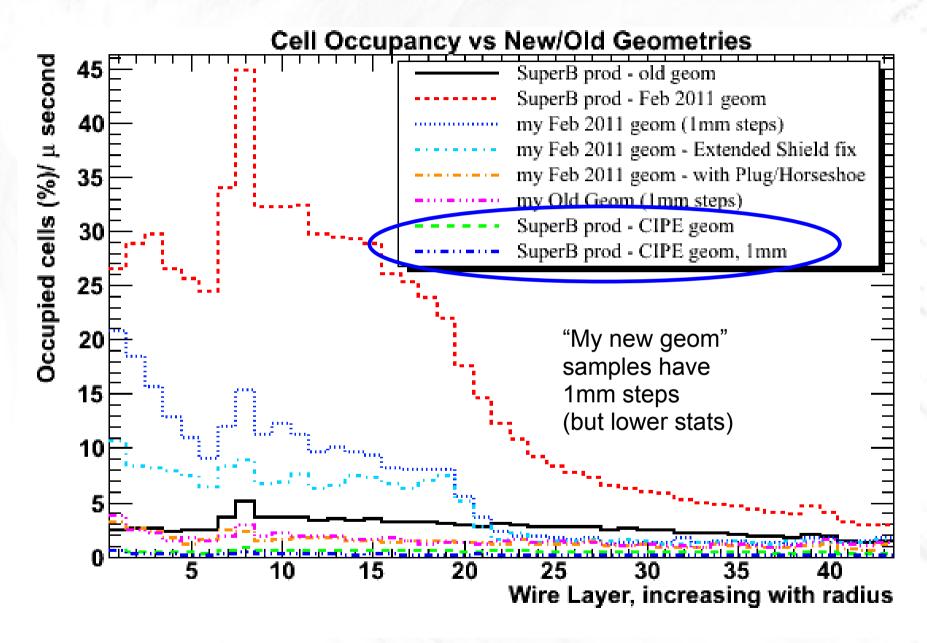
<u>Latest "CIPE" geometry (not shown here!)</u>

- 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

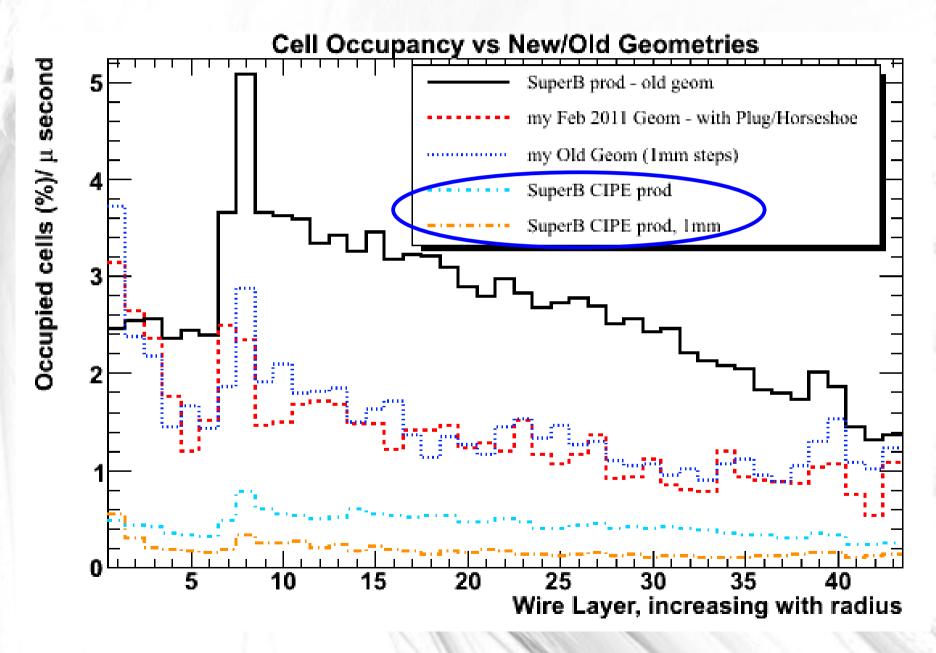




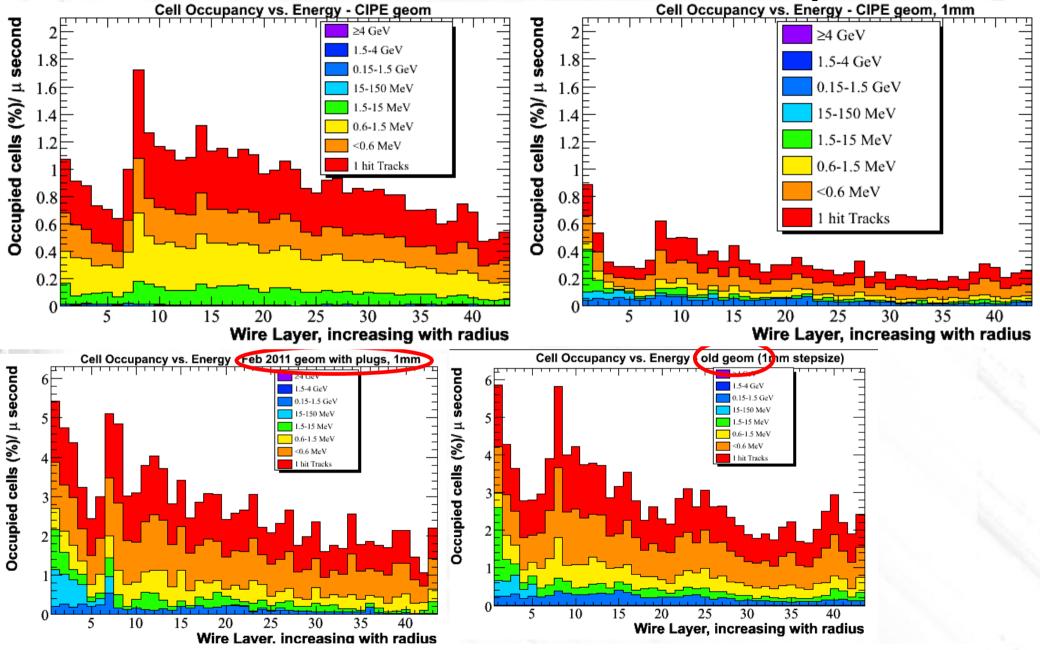
Comparison of Samples (Bruno only)



Comparison of Samples (Bruno only)



Latest "CIPE" Geometry

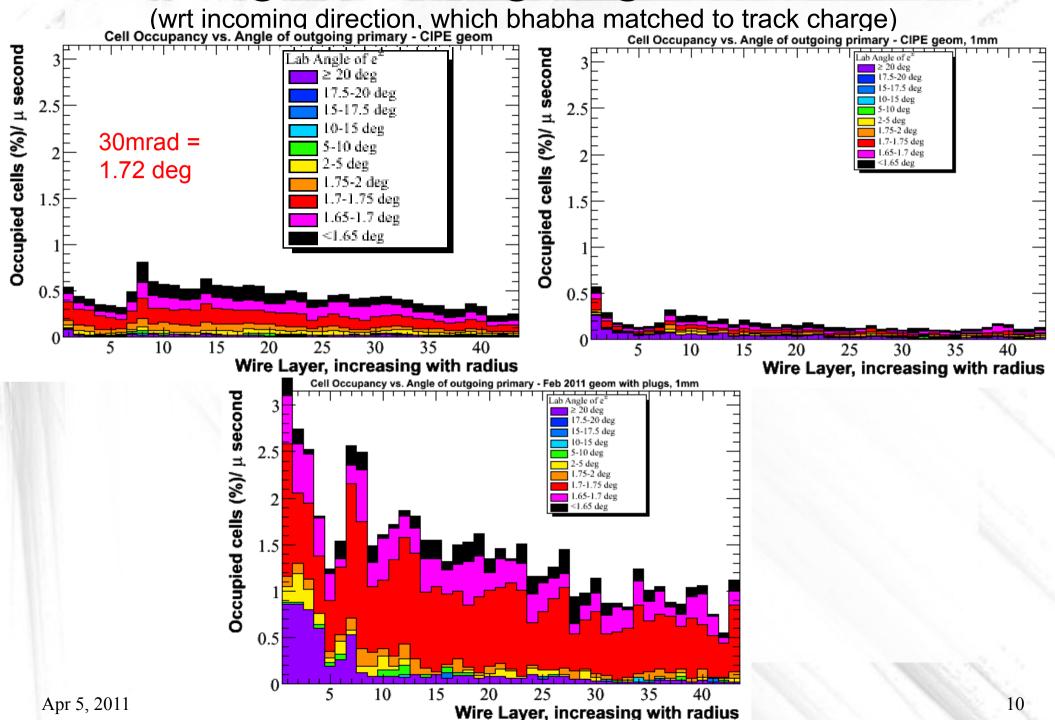


Note: Due to splitting plots into stacked colored "bins", it's possible for 2 tracks from same event to double count on a wire, resulting in falsely higher occupancies.

E of Originating Bhabha (or photon)



Angle of Outgoing Bhabha



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 10^{2} 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 Apr 5, 2011

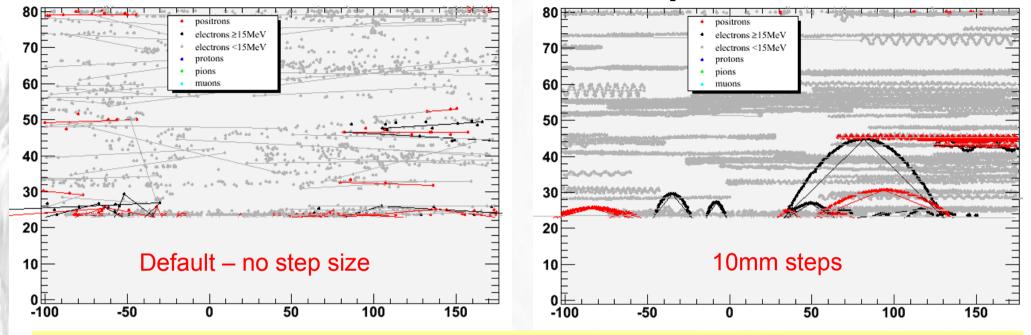
Track-producing Bhabhas/parents (II) Hit positions of Track-causing Bhabha primaries - new Geom Origin of Track's Parent(+) vs. Z - new Geom Origin of Track's Parent(+) vs. Z - new Geom 10 සි Track's parent must be outside DCH. If it is not, I use grandparent, or great- grandparent, et 10 9000 9000 -500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



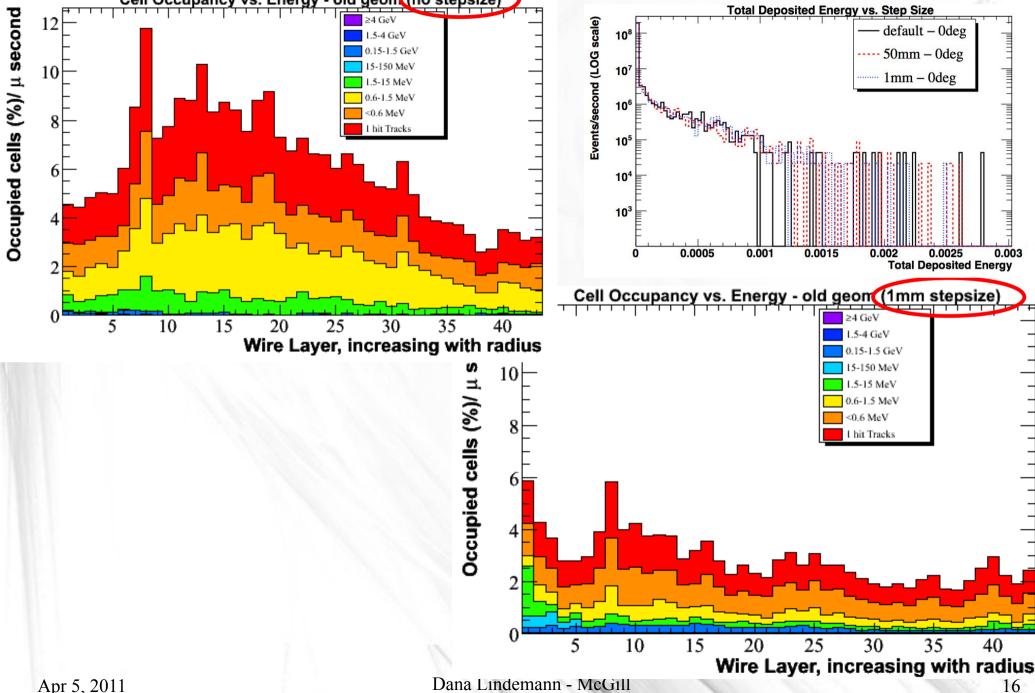
Same 200 events (>5deg) with tracks 1.5MeV < E < 150MeV, hits with deposited E > 0 only

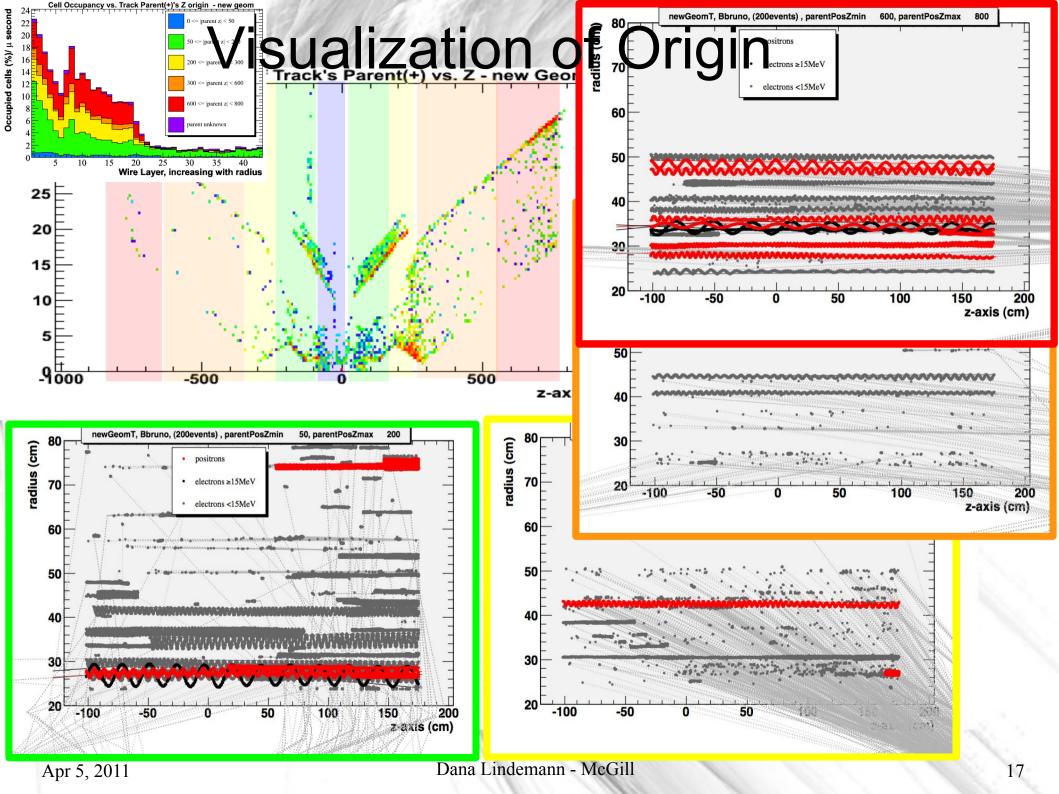
New occupancy method:

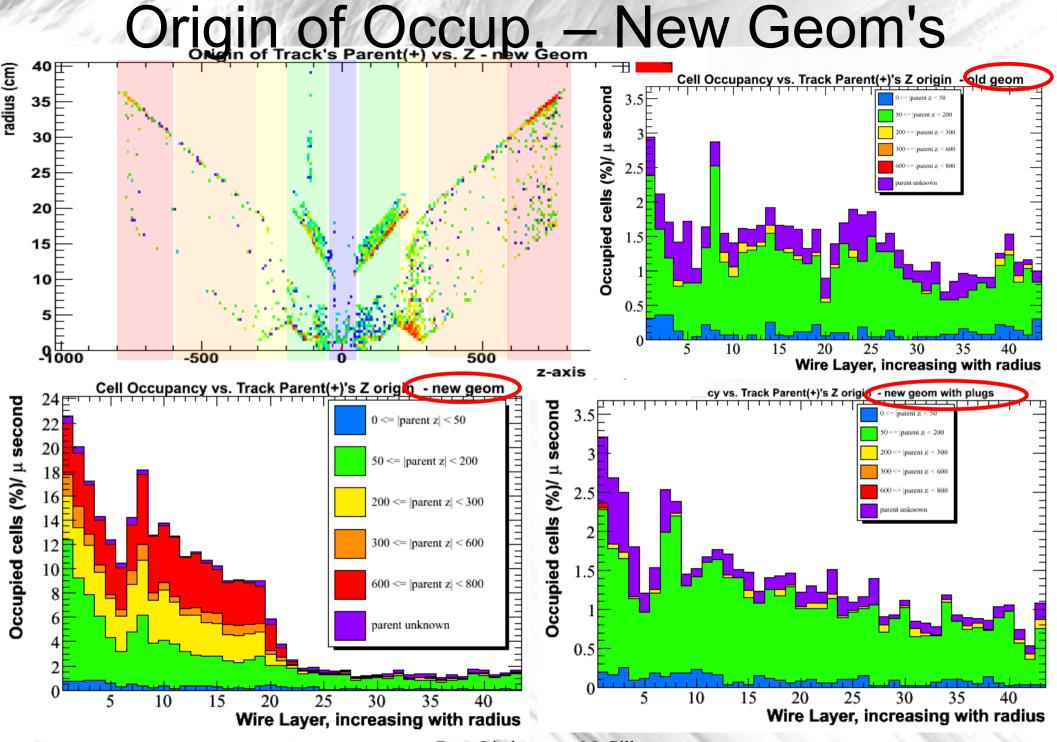
With smaller step-sizes (1mm Bruno & 10mm Bhwide), each instance of deposited energy counts as one "hit" on whichever wire is closest (axial wires only). Only one hit/wire/event is allowed.

Step Size vs. Occupancy (old geom)

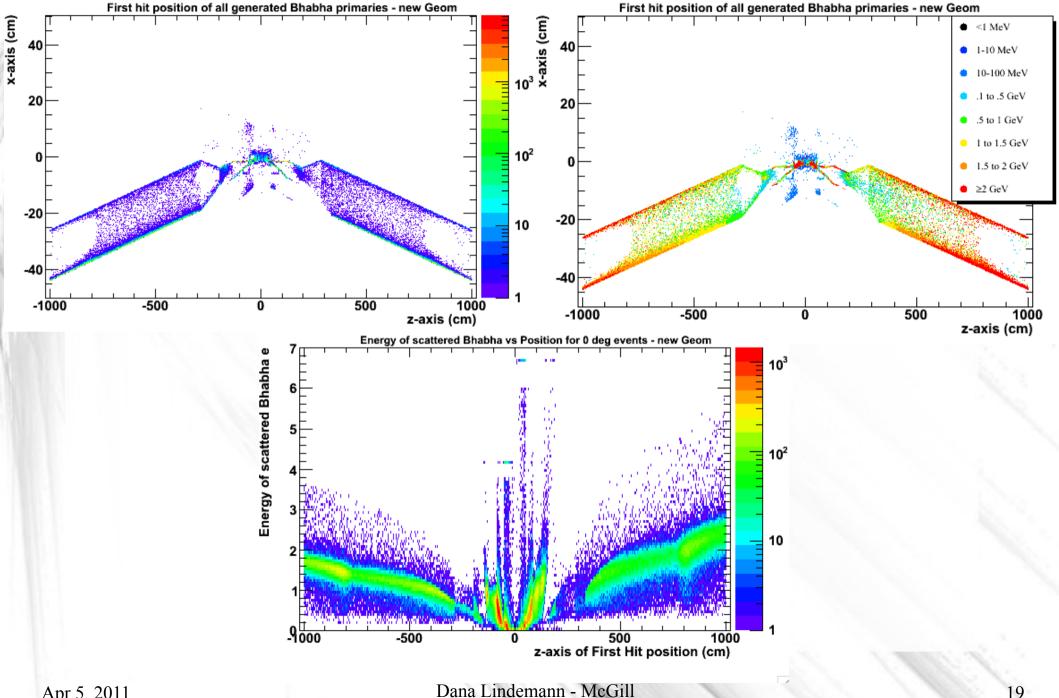
Cell Occupancy vs. Energy - old geom (no stepsize)







Where Bhabhas First hit the pipe

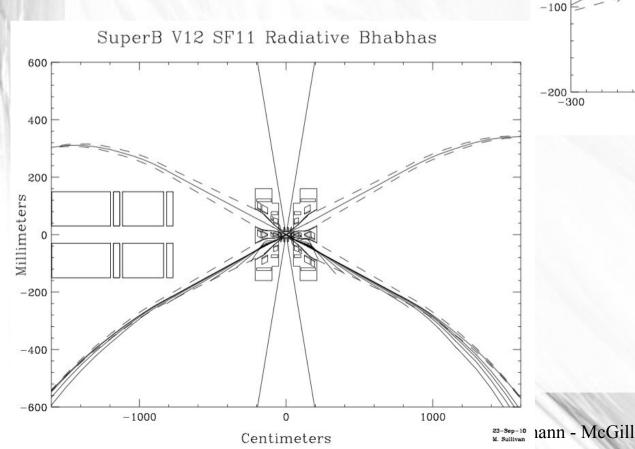


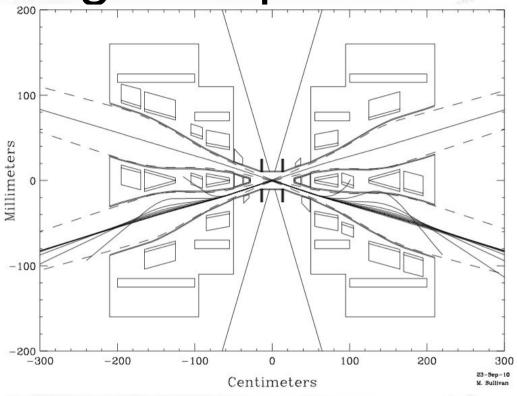
Apr 5, 2011

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 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

Plot show 0.5-4 GeV in 0.5 increments





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

