DCH Bkg study with FullSim: Feb 2010 production



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Production configuration

- Modified geometry from previous studies:
 - Additional DCH shielding
 - Dirc added
 - Different shielding
- 5 configurations for Radiative Bhabha:
 - Default (DeltaE 10%), 200k evts
 - Unshielded, 200k evts
 - Lower DeltaE: 1%, 200k evts
 - Lower DeltaE: 0.2%, 200k evts
 - High precision neutron tracking, 100k evts (not so interesting for us)
- Delta E is the minimum energy variation of the radiating particle

Background study details

- Dch structure
 - Minimum radius 24 cm
 - Cells 1.3x1.3 cm
 - Only Axial, Babar, SuperB layers structure
- Still no cut on cells accumulated energy
- Important issue
 - for this production the Geant step size has not been limited in DCH volumes
 - A single step can go across two cells or more
 - Average step is 2.6cm, with some cases of 1m step and more
 - Results should be corrected, more later

Hits distribution (z coordinate)

- Z distribution confirms that most part of the hits is coming from the endplates
- Peak at +110cm?



Hits distribution (step length, elap time)

- For >78% of the hits, the step length is less than 1cm, mean value is 2.6cm
- ElapTime = The max time between two dch hits in the same evt is less than 50ns for 95% of evts
- Hits from other bunch-crossings in the same daq time are negligible



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Cells Energy

 Energy released in each cell peak around 10keV for all the layers, with a long tail

 A lot of cells with energy lower than 5 keV in the last layer (79.2-80.5cm, but gas ends at 80cm so reduced size cell)



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Cells On per Layer, Occupancy

Absolute number of cells with released energy

Total occupancy: 2.5% with an RMS ~0.6%



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Occupancy

 New results not exactly statistically compatible with old ones

 Again stereo layers does not make so much difference for bkg, less than 0.5%

Maybe related to step size issue

Axial 2.48% Babar 2.60% SuperB 2.64%



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Other configurations

- Unshielded (more a test than a real option)
 - Occupancy up to 31.4±1.4%
- Lower DeltaE minimum
 - DeltaE >5%, Occup 2.48% -> 2.54%
 - DeltaE >0.2%, Occup 2.48% -> 2.82%
 - Small differences
- High precision for neutrons
 - Negligible differences, Occup 2.48% -> 2.50%

2photons (aka Pairs) bkg

- I simulate again with the new geometry the 2photons bkg (40k evts), unfortunately I discover a bug in the settings so no reliable results now
- Anyway with bug processing I tried to understand any difference using different step size
- Weird difference, total occupancy is similar anyway



Conclusions

- Production allows us to have statistically significant plots for RadBhaBha bkg
- Significant increase in occupancy, probably due to change in geometry and shielding
- Step size issue, need to be fixed. Better add more information on Dch hits, than limiting the step size (cpu time consuming)

FullSim version and geometry

Bruno r353

• Geometry:

- Beampipe (BP): 1mm thick, Rmin 10mm
- Gold foil inside BP: 3um
- SVT L0 length 10 cm, thickness 300um, Rmin 1.3cm
- BaBar SVT
- Cylindrical drift chamber
 - Rmin 230mm, Rmax 800mm but layers from 240 through 805mm
 - Length 2775mm, centered at z = +367mm
 - Carbon fiber structure filled by material with density averaged from gas and wires

DCH configurations

Dch cell configuration:

- Inner radius: 24 cm, Outer radius: 80.5cm
- 1.3 (r) x 1.3 (phi) cm, cell size
- Superlayer made by 4 layers
- 10 superlayers (spaced 0.5 cm), ~10k cells
- Cells are not staggered

Superlayer configuration

- Axial only version
 - AAA AAA AAA A
- Babar version
 - AUV AUV AUV A
- SuperB version
 - A UV UV UV UV A
- Stereo angles like Babar

BaBar NIM paper

	# of	Radius	Width	Angle
SL	Cells	(mm)	(mm)	(mrad)
1	96	260.4	17.0-19.4	0
2	112	312.4	17.5 - 19.5	45 - 50
3	128	363.4	17.8 - 19.6	-(52-57)
4	144	422.7	18.4 - 20.0	0
5	176	476.6	16.9 - 18.2	56 - 60
6	192	526.1	17.2 - 18.3	-(63-57)
7	208	585.4	17.7 - 18.8	0
8	224	636.7	17.8 - 18.8	65 - 69
9	240	688.0	18.0-18.9	-(72-76)
10	256	747.2	18.3 - 19.2	0

Results with different stereo configurations

Rough estimations by Giuseppe (last meeting)

SLs	f _{axial}	المراجعة (N _{stereo})	f _{stereo}
1,2,3	76/1344/6.1= <mark>0.93</mark> %	2764/18.2*0.051= 7.7	0.93 ^{%*} 7.7 = <mark>7.2</mark> %
4,5,6	64/2048/6.1= <mark>0.51</mark> %	2764/18.2*0.060= 9.1	0.51%*9.1 = <mark>4.6</mark> %
7,8,9,10	92/3712/6.1= <mark>0.41%</mark>	2764/18.2*0.071=10.8	0.41%*10.8= <mark>4.4</mark> %
1-10	232/7104/6.1= <mark>0.54</mark> %	2764/18.2*0.051= 9.1	0.54% *9.1= <mark>4.9</mark> %

Increase in occupancy not as expected

