DCH Background study using FullSim

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Update on DCH background study

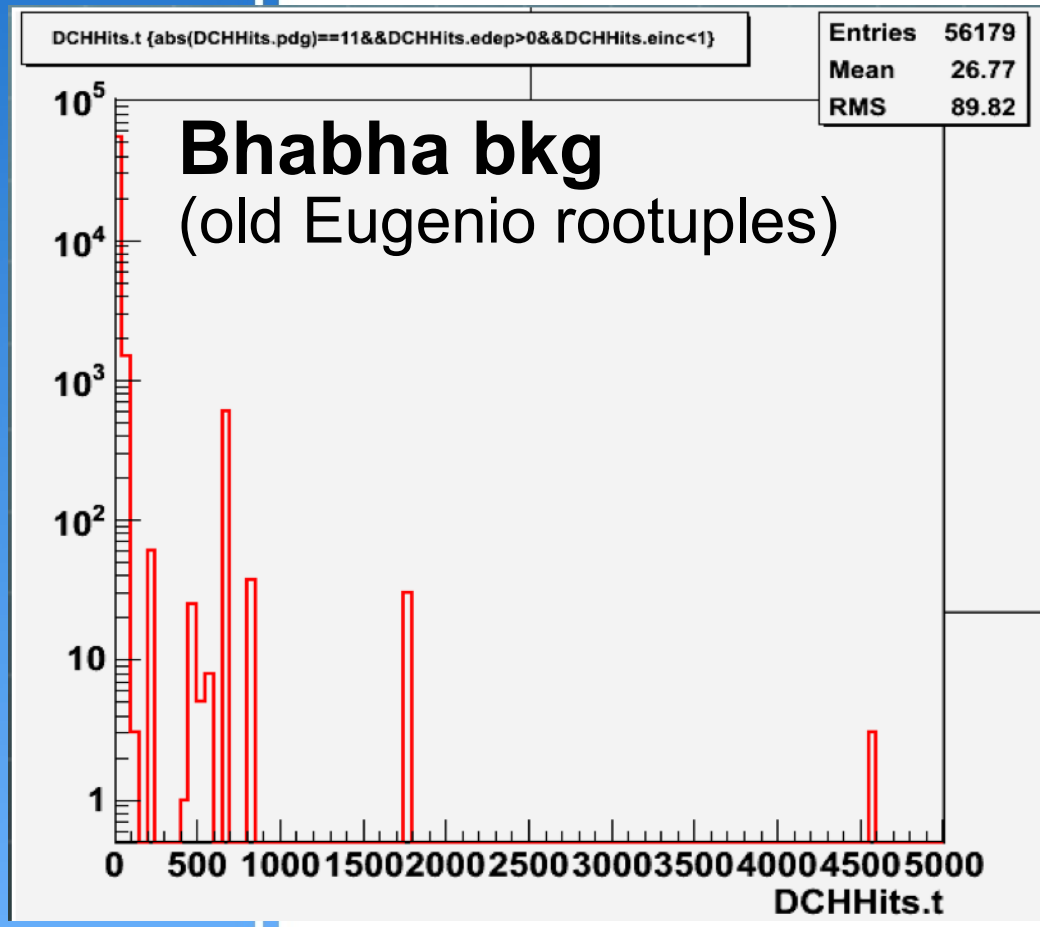
- Additional checks on G4 simulation output
- Stereo layers
- Different configurations, first look at:
  - Thinner tungsten shielding upstream and downstream of the IP
  - Axial only, Babar or SuperB layers configuration
  - '*Wedding cake*' endplate on Fwd side

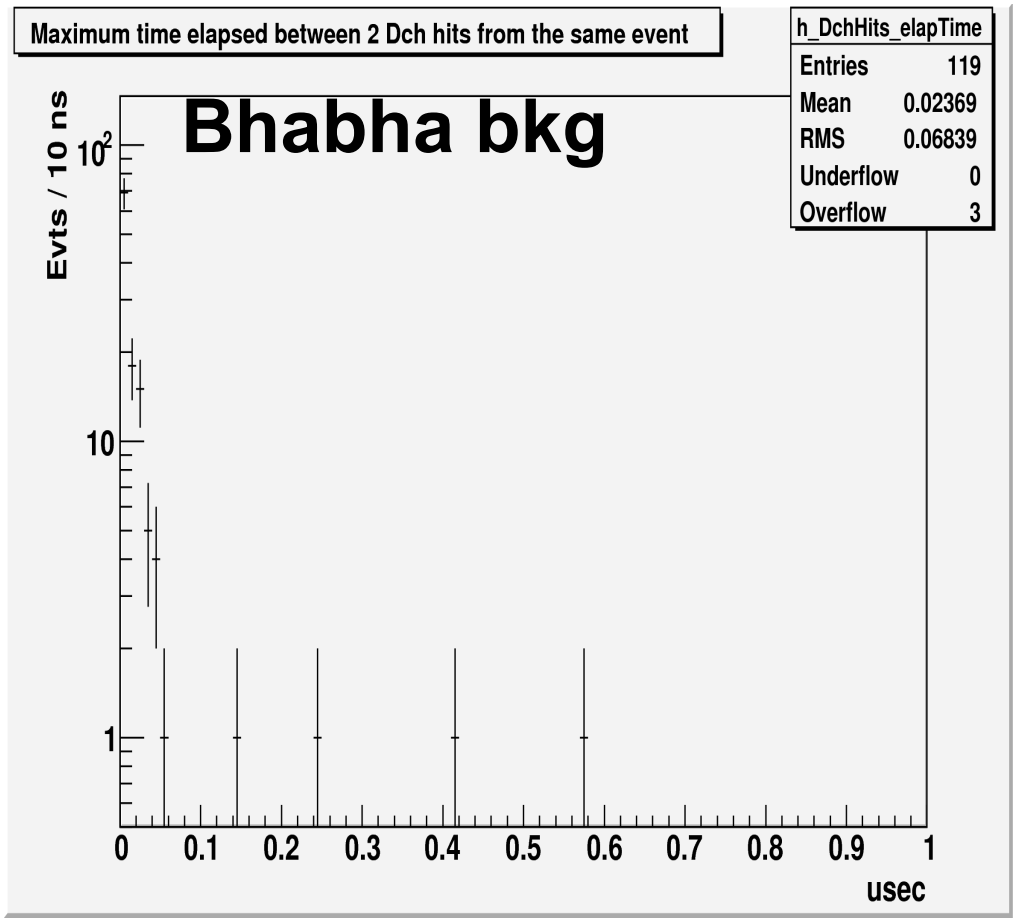
FullSim version and geometry

- **Bruno v00-01-04, r247**
  - Old version, no committing or updating for work in progress on splitting in packages and fixing bugs
- **Geometry**:
  - Beampipe (BP): 1mm thick, Rmin 10mm
  - Gold foil inside BP: 10um
  - SVT L0 length 10 cm, thickness 300um, Rmin 1.3cm
  - BaBar SVT
  - Cylindrical drift chamber
    - Rmin 230mm, Rmax 830mm but **layers from 240 through 800mm**
    - Length 2775mm, centered at z = +367mm
    - Carbon fiber structure filled by material with density averaged from gas and wires

Additional checks: hits timing

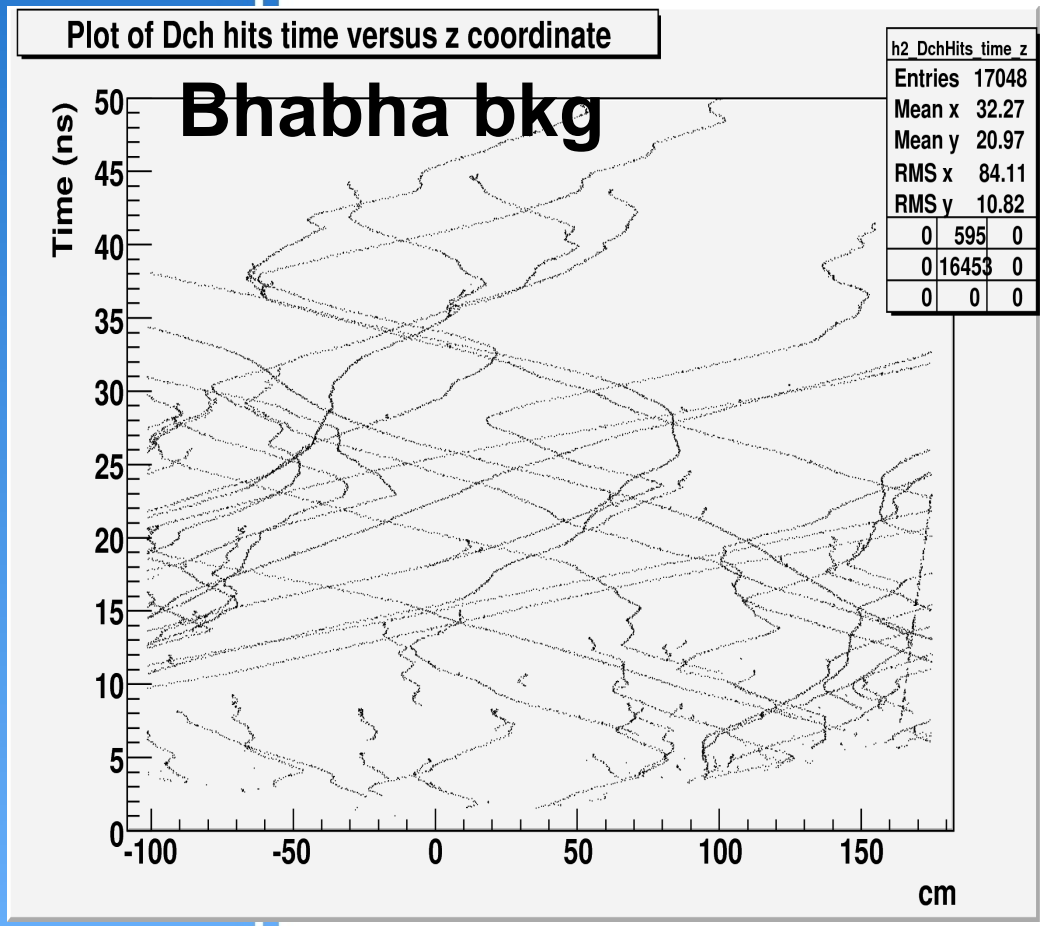
- Hits absolute time more than 1us
- Max time between 2 hits from the same event is almost always less than 1us (116 out of 119 evts)

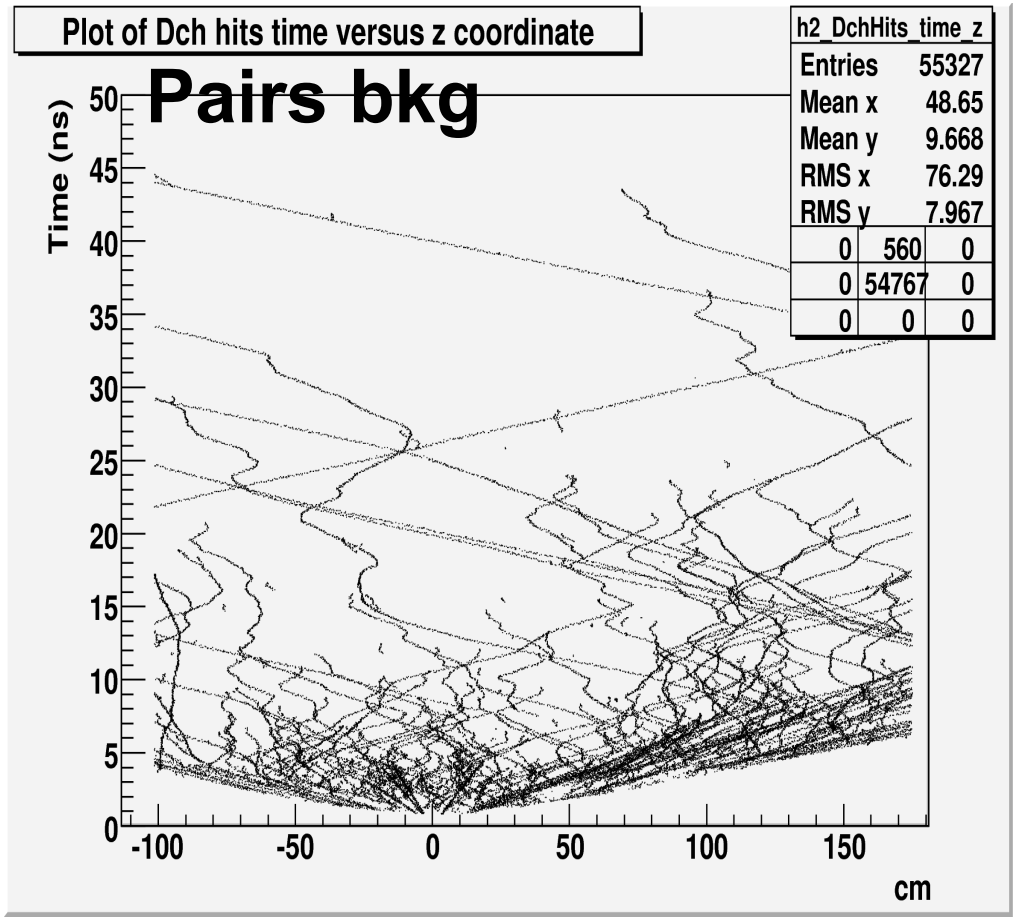




Additional checks: time vs z

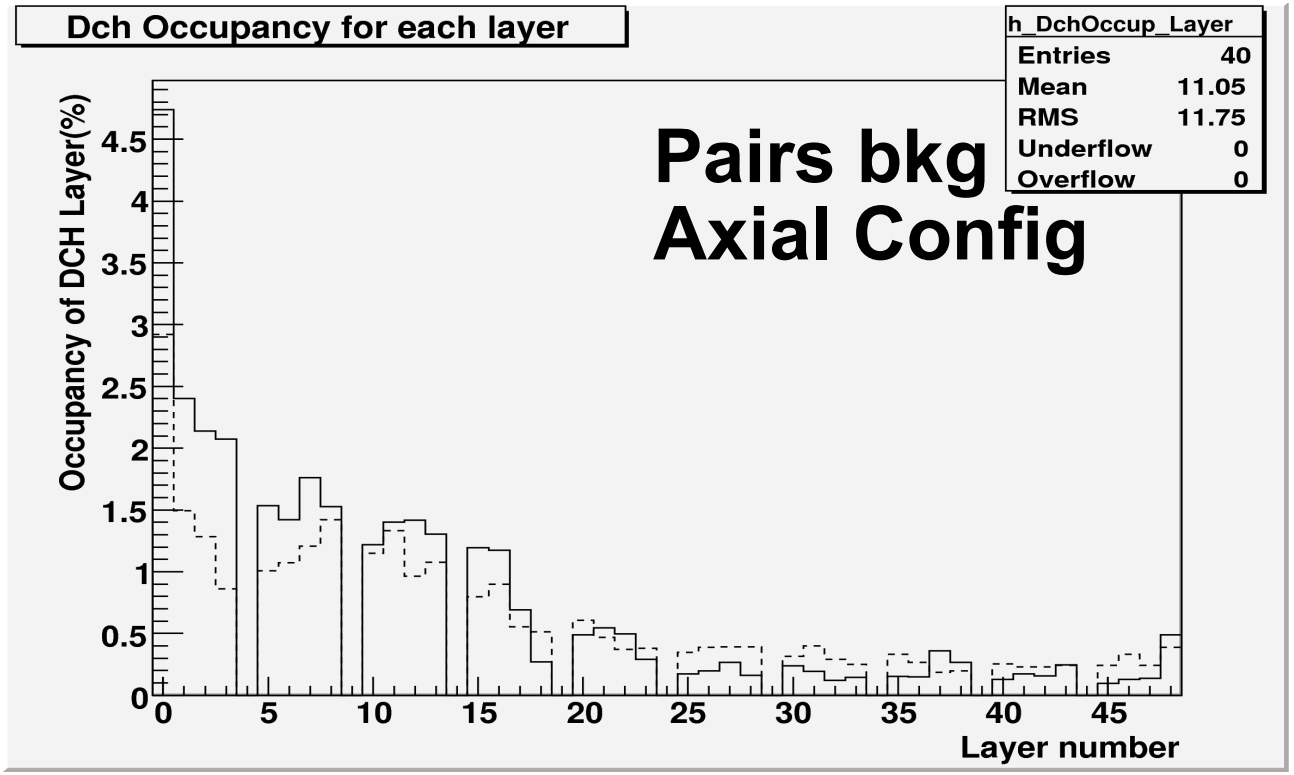
- Backscattering still not understood, prob need more info stored into hits, as already done for Svt
- Significant differences between Pairs and Bhabha Rad bkgs





Getting the DCH occupancy...

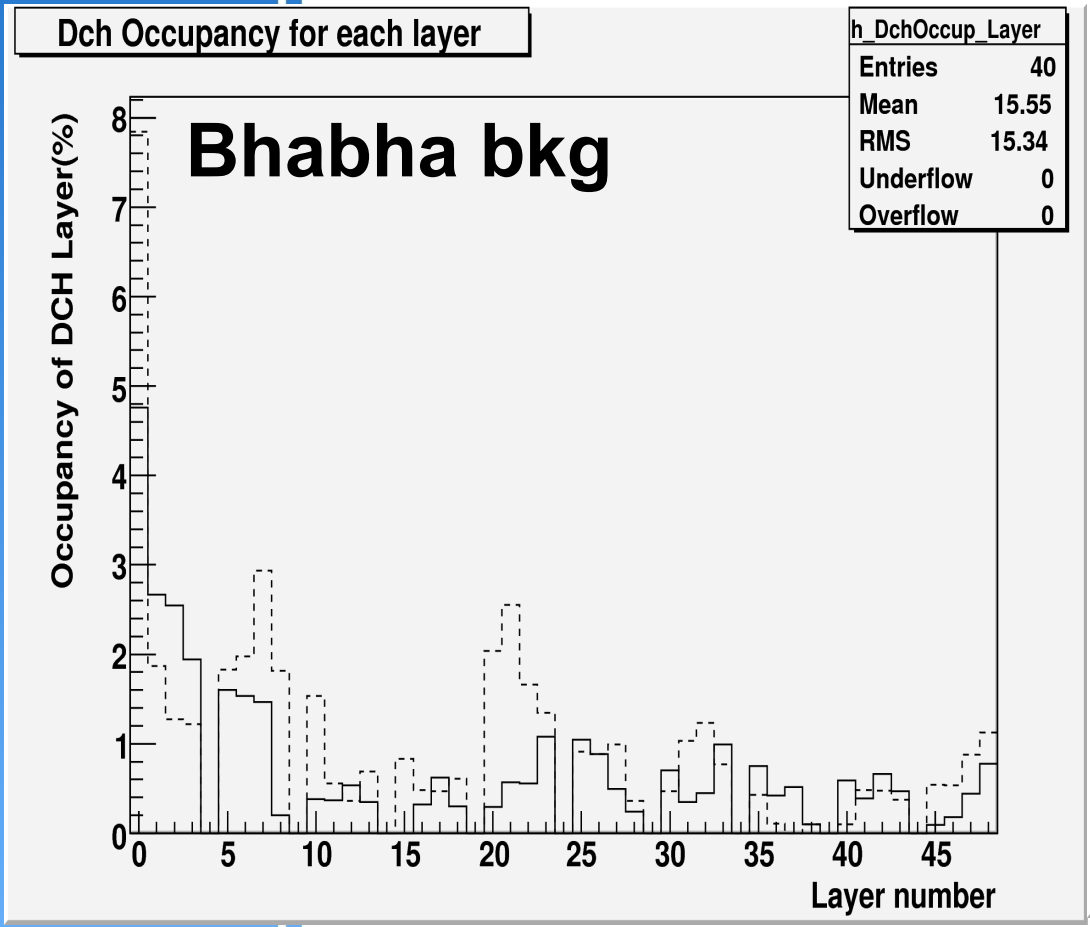
- Occupancy algorithm checked, improved code
- DCH occupancy not affected by bug in SVT bkg
- Tested changes in occupancy with 0.5cm G4 step (solid) instead of 1cm (dashed)

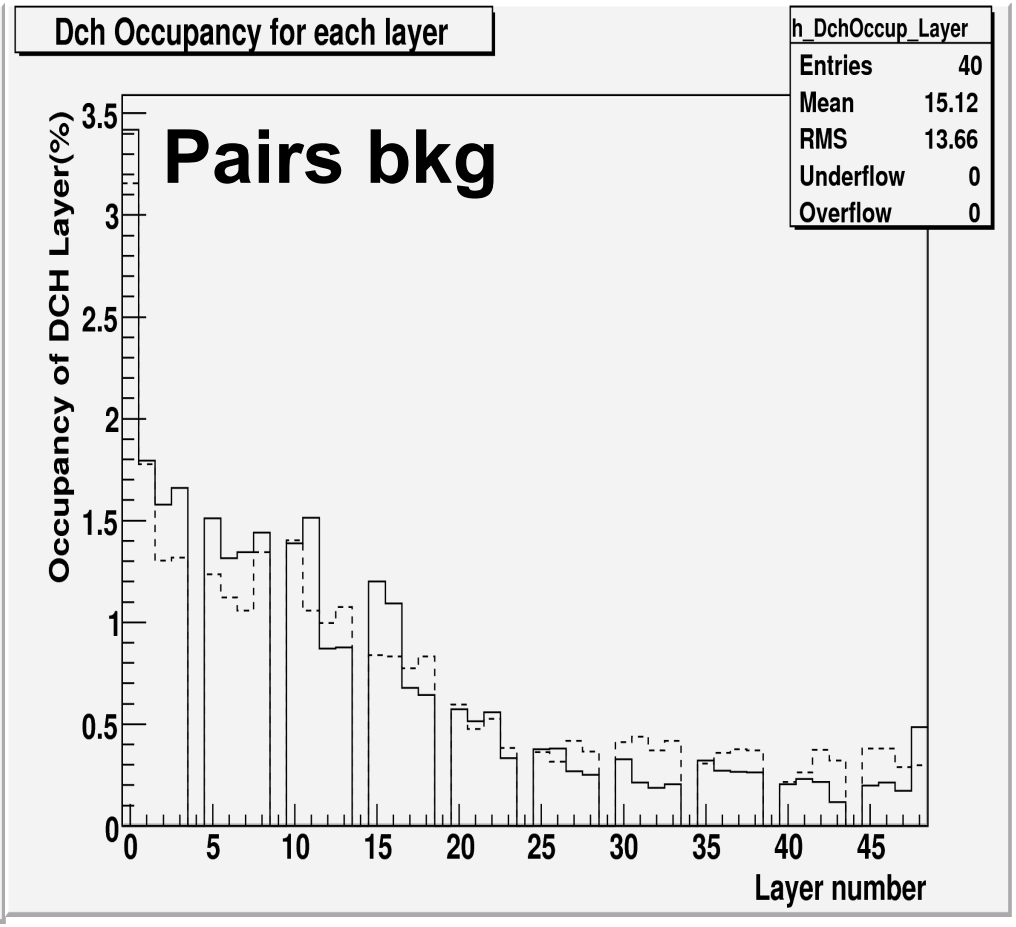


- Occupancy changes but also processing time increase a factor 6, workaround needed

Thinner Tungsten shielding

- Tungsten shielding upstream and downstream
- Configuration with thinner version of shielding, 2-3.5 times less (dashed line)





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

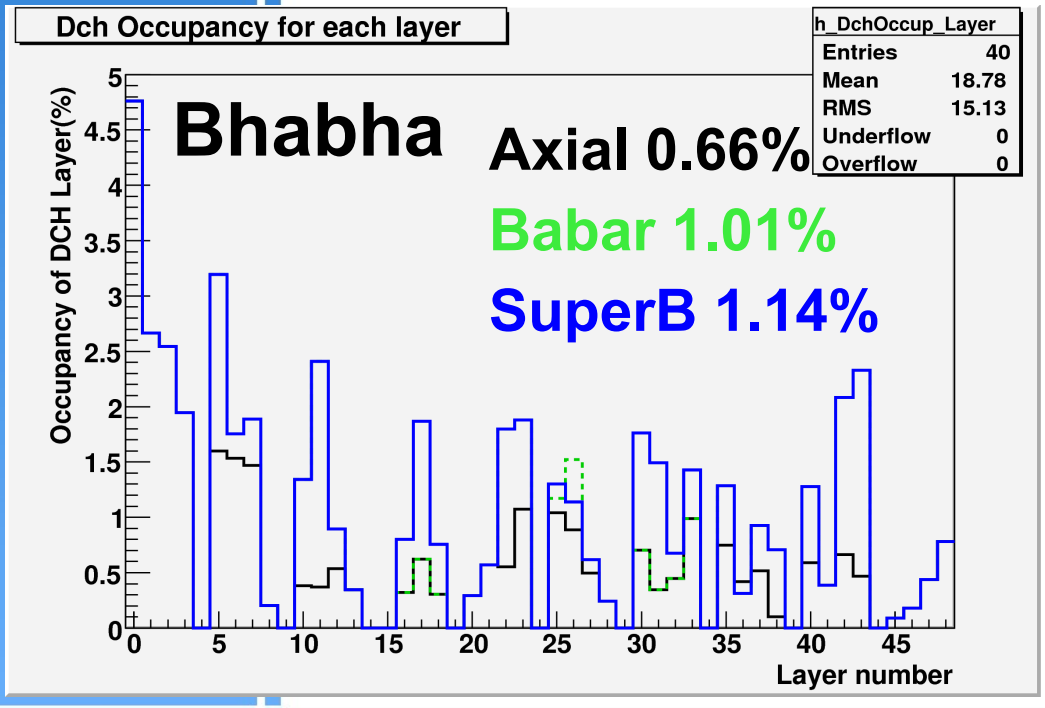
SL	# of Cells	Radius (mm)	Width (mm)	Angle (mrad)
1	96	260.4	17.0-19.4	0
2	112	312.4	17.5-19.5	45-50
3	128	363.4	17.8-19.6	-(52-57)
4	144	422.7	18.4-20.0	0
5	176	476.6	16.9-18.2	56-60
6	192	526.1	17.2-18.3	-(63-57)
7	208	585.4	17.7-18.8	0
8	224	636.7	17.8-18.8	65-69
9	240	688.0	18.0-18.9	-(72-76)
10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

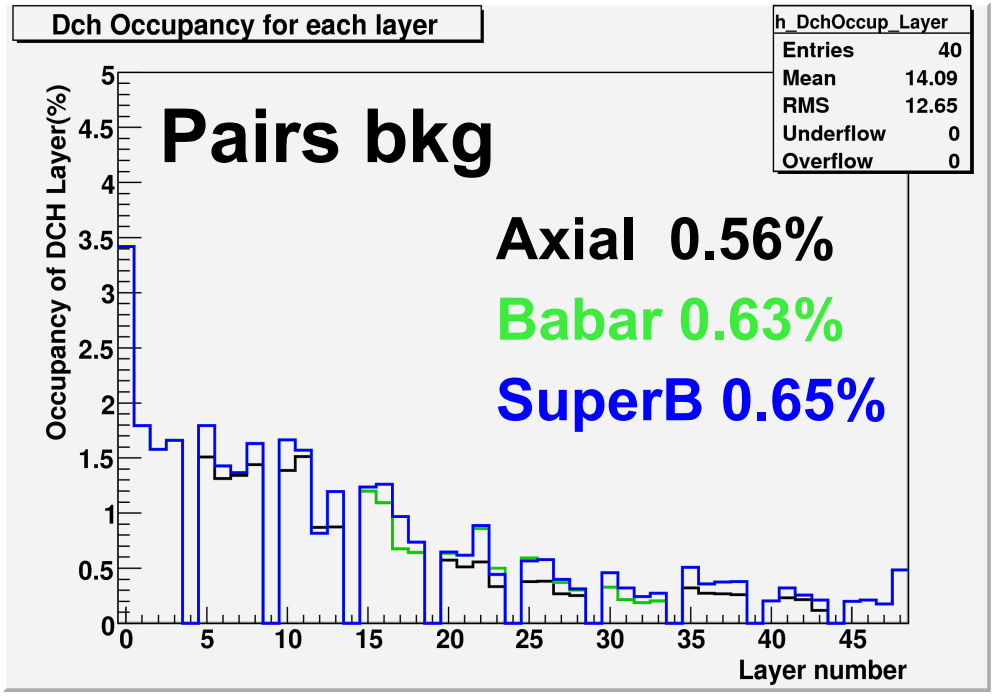
Results with different stereo configurations

- Rough estimations by Giuseppe (last meeting)

SLs	f_{axial}	$\langle N_{stereo} \rangle$	f_{stereo}
1,2,3	76/1344/6.1=0.93%	2764/18.2*0.051= 7.7	0.93%*7.7 = 7.2%
4,5,6	64/2048/6.1=0.51%	2764/18.2*0.060= 9.1	0.51%*9.1 = 4.6%
7,8,9,10	92/3712/6.1=0.41%	2764/18.2*0.071=10.8	0.41%*10.8=4.4%
1-10	232/7104/6.1=0.54%	2764/18.2*0.051= 9.1	0.54% *9.1=4.9%

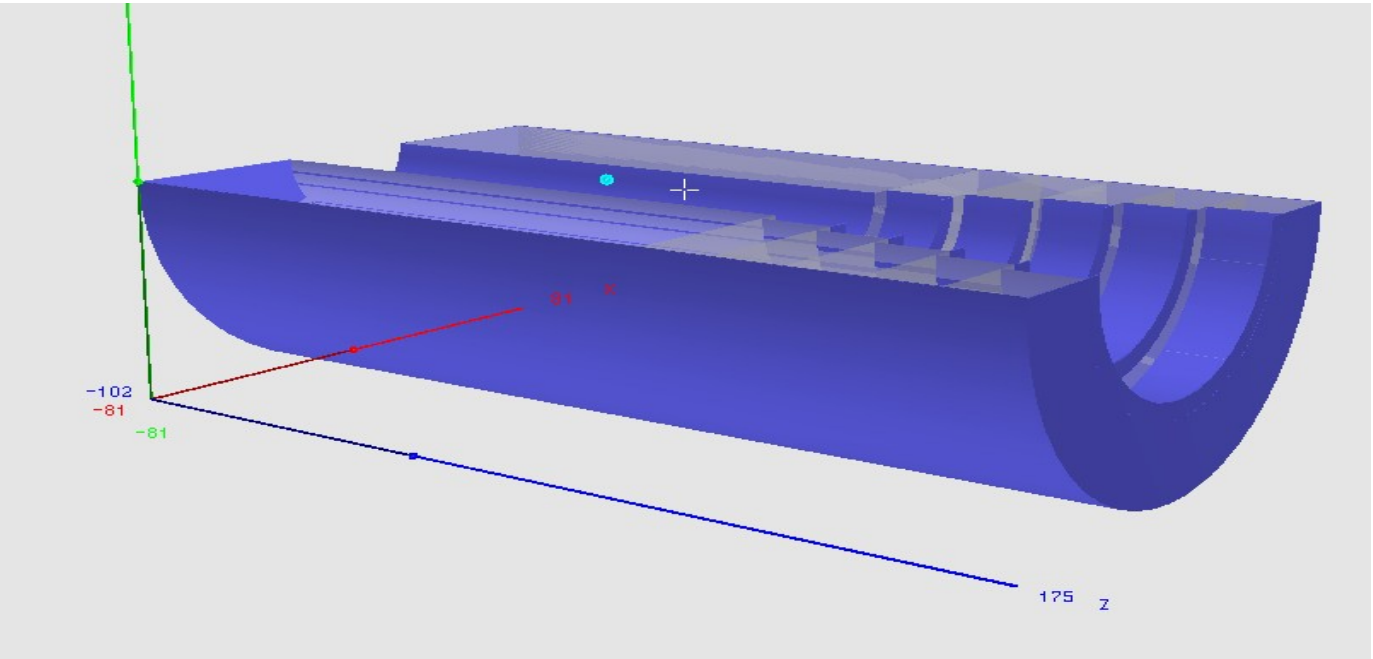
- Increase in occupancy not as expected





Wedding cake DCH

- GDML code for wedding cake Dch



- 5 Step, r step 6.1cm, z step 20cm
- Occupancy increase about a factor 2 to 10, not reasonable, probably some errors (GMDL code?)
- Need more checks on that

Conclusions

- Some additional checks performed: simulation is ok but occupancy is step-dependent, need to be fixed
- Occupancy can be estimated including also stereo layers
- Starting studying new configurations, geometry (thinner tungsten shield and wedding cake endplate) or layers structure (only axial, Babar and mostly stereo layers structure)
- Overall occupancy estimation is reasonable
- Lack of statistics still a major problem, jobs are really time expensive for radiative Bhabha (reduce the production angle?)