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 bkg

**Bhabha bkg**

**Pairs bkg**
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: **80.5 cm**
  - 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

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<table>
<thead>
<tr>
<th>BaBar NIM paper</th>
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<tbody>
<tr>
<td>SL</td>
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<td>1</td>
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Results with different stereo configurations

- Rough estimations by Giuseppe (last meeting)

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