

# *SVT Background study using FullSim*



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# Goal for this background study

- **Occupancy** of Drift Chamber
- Parameters:
  - Chamber inner radius
  - Cells size
  - Stereo or axial superlayers
  - Different shape of endplates
  - Cell shape

# FullSim version and geometry

- **Bruno v00-01-04, r247**
  - Only Svt code has been committed
- **Geometry:**
  - Beampipe (BP) thickness: 1mm
  - SVT Layer 0 is a tube, not a pin-wheel
  - SVT L0 length 10 cm, thickness 300um, Rmin 1 cm
  - BaBar SVT
  - Gold foil outside BP: 10um
  - BP and L0 centered at  $z = 0$
  - Cylindrical drift chamber
    - Rmin 230mm, Rmax 830mm
    - Length 2775mm, centered at  $z = +367$ mm
    - Carbon fiber structure filled by material with density averaged from gas and wires

# Background events

- **Beam-strahlung (radiative Bhabha's)**
  - 1k evts
  - Processing time: 30 evts/hour
  - Generator embedded into Bruno
- **Pairs production**
  - 40k events
  - External standalone generator
  - Processing time: 10k evts/hour
  - Main known bkg for SVT
- Not a big statistics for Svt outer layers and Dch
- More events can be generated or any other bkg events, if readable by Bruno, can be used to produce easily the same plots

# Clean-up, fixes and additions

- Main geom parameters to be changed written in a single file, **SuperB\_constants.xml**, included in different GDML modules
- Geometrical par's can be written into the Root file as TParameter
- G4 geometry tolerance set to main volume size to avoid crashing jobs
- Geometry checked for overlapping over all the volume levels:
  - Output file @CNAF:  
/home/BABAR/cenci/simu\_sb/Bruno/out/geomtestfull/geomtestfull\_090930.log
  - Problems in SVT, many from EMC (visualization problem with HepRep), still need to go through it
- G4Step reduced to 1cm for e+ and e-: technical issue, just to have hits points along the track, don't affect physics

# Bruno Hits

- Hits stored corresponds to G4Step
- Many similar classes for different subsysts, starting to write a common class and derive specific ones when needed (not yet in repo)
- **Bruno hits**
  - Starting point coordinates, time, step length, incident and released energy, particle and track ID

# Getting the DCH occupancy... (1)

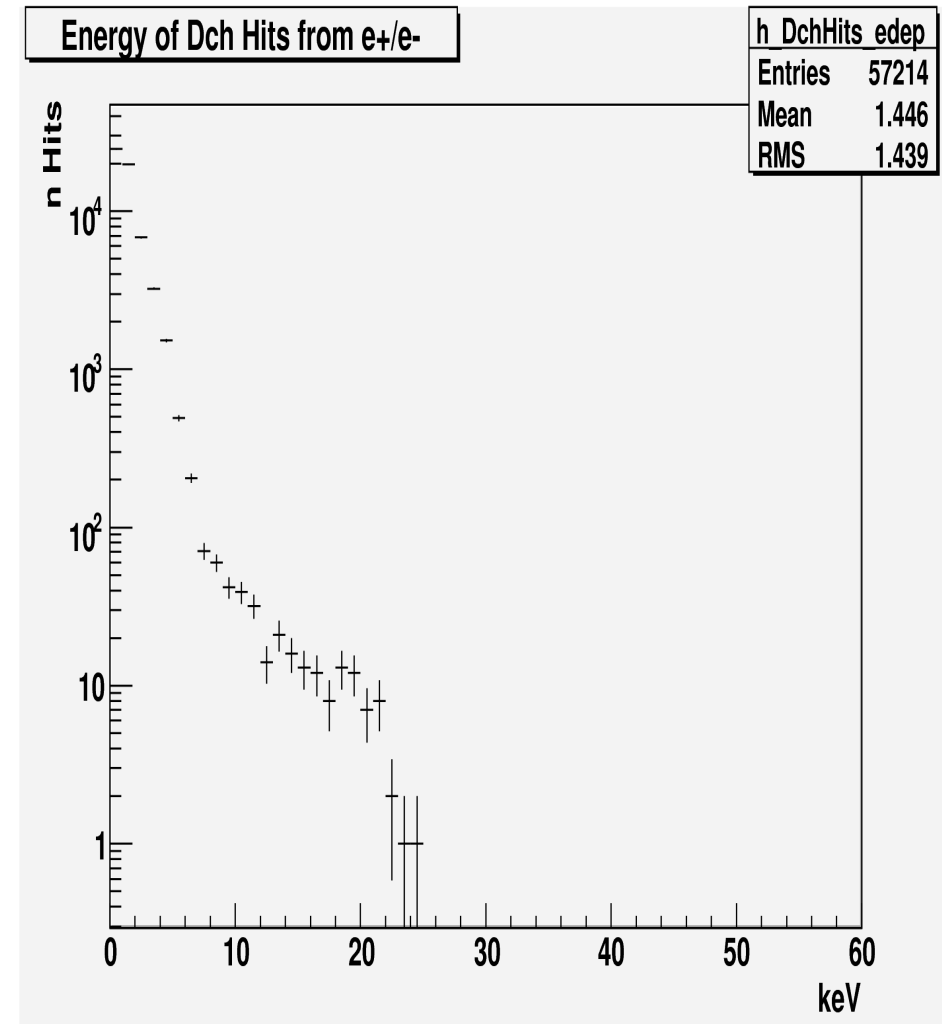
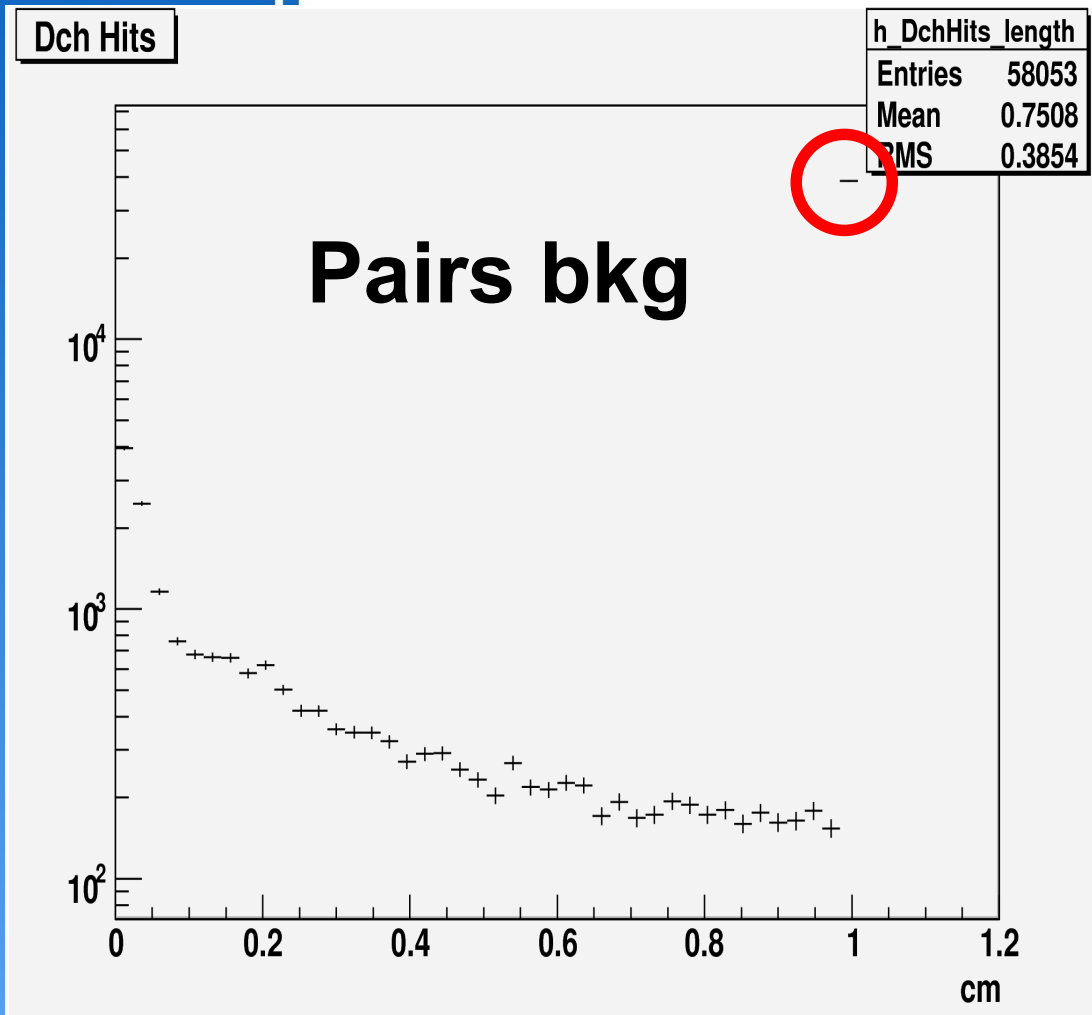
- **DCH Hits** on Root file are std Bruno hits
- A **DchRootStructure** object is build by a Root macro using superlayer objects, made by layer objects. Layers are defined only by cell size  $r$  and  $\phi$
- DchRootStructure contains the number of cells per layer and a matrix with the energy released for each cell
- Processing the root file, we match each hit with a cell and add the energy in the matrix
- One event of bkg sample is not equivalent to the Daq Dch slot (1us, is it ok?), so we collect hits from more events: 750 for pairs, 266 for bbbrem bkg (to be checked)

## Getting the DCH occupancy... (2)

- **Basic Dch configuration:**
  - Inner radius: 23 cm, Outer radius: 83.5cm
  - 1.4 (r) x 1.4 (phi) cm, cell size
  - Superlayer made by 4 layers
  - 10 superlayers (spaced 0.5 cm), **9540 cells**
  - Cells are not staggered
  - Only axial layers
- **Caveats:**
  - Hits correspond to energy release in 1cm or less, it can be shared by two cells
  - Low statistics
  - Particles with very low energy, trajectories are small spirals through z (1 or 2 cells)

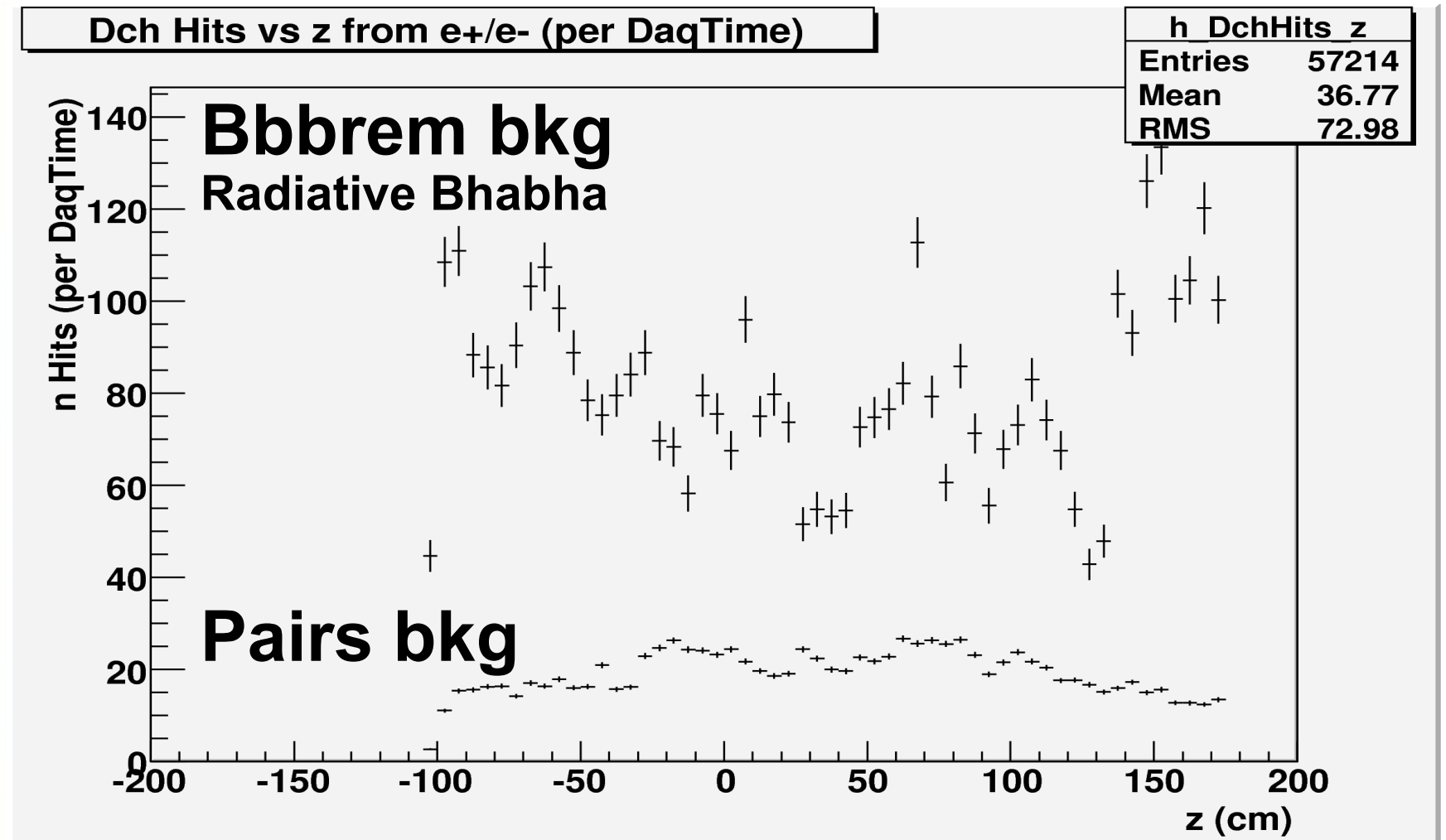


# DCH Hits length and energy



- Huge **peak** in step length at 1cm, as from Bruno setting
- Mean released energy compatible with MIP in Dch gas

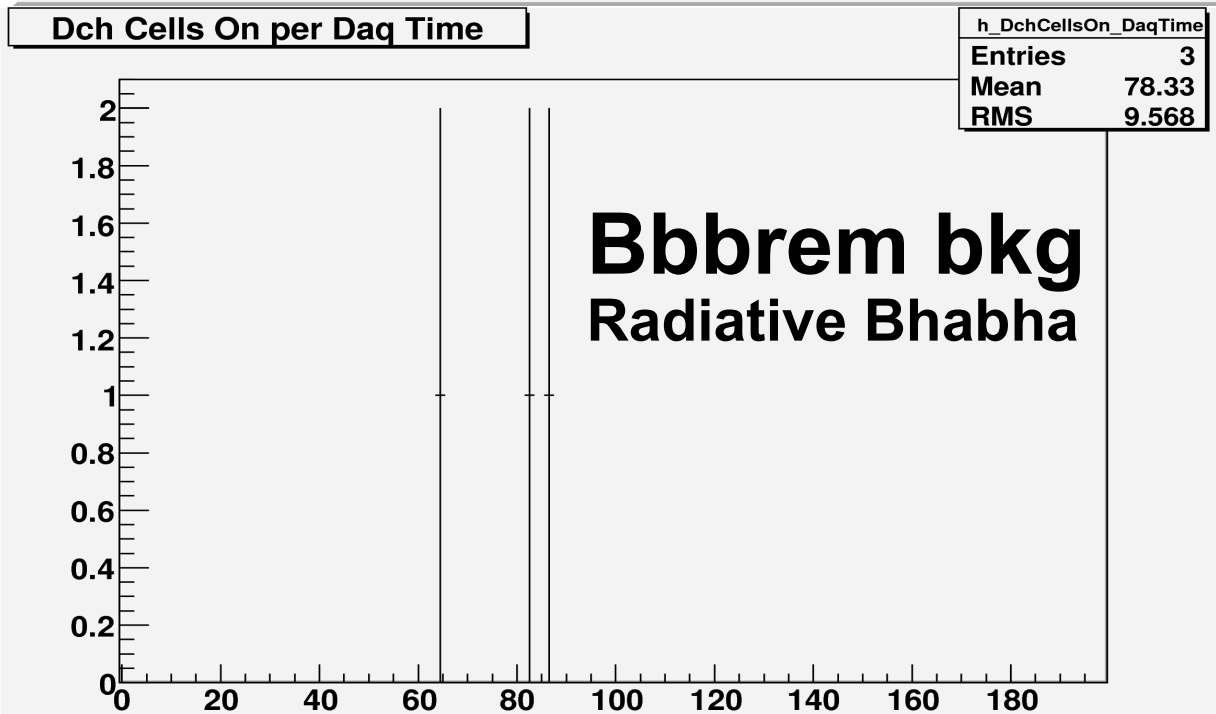
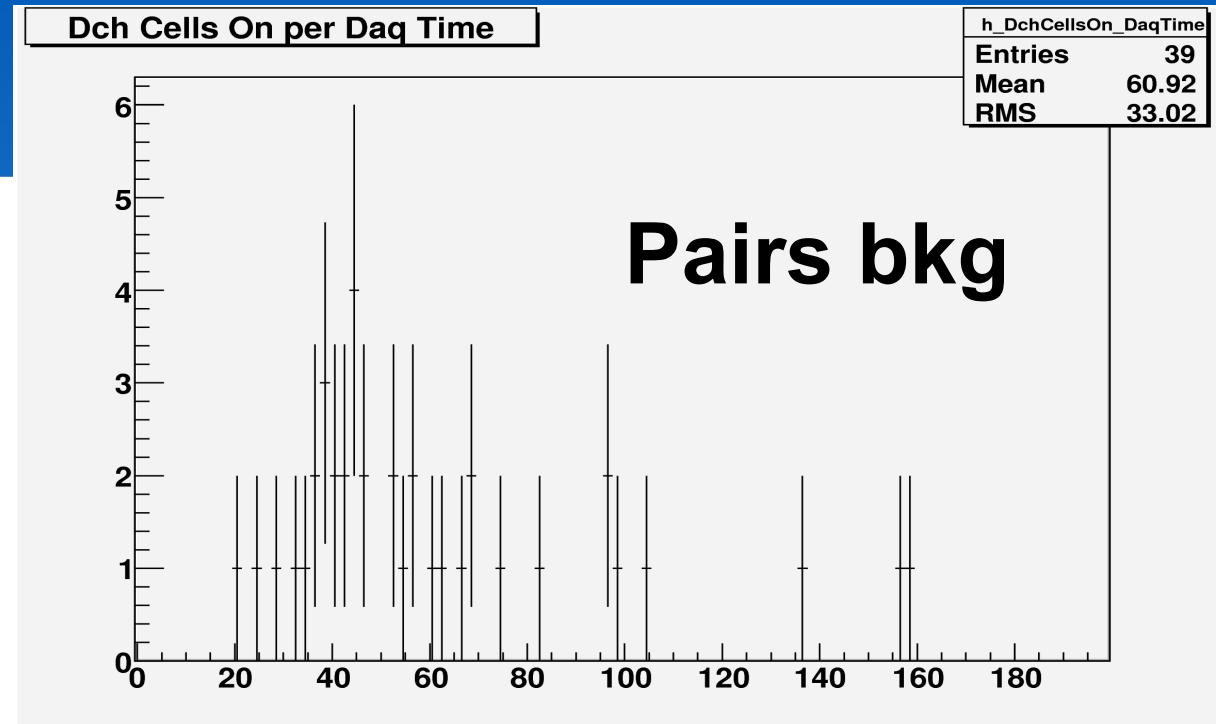
# DCH Hits vs z



- Not weighted by released energy
- Bump on fwd direction for Radiative Bhabha, pretty flat for Pairs bkg

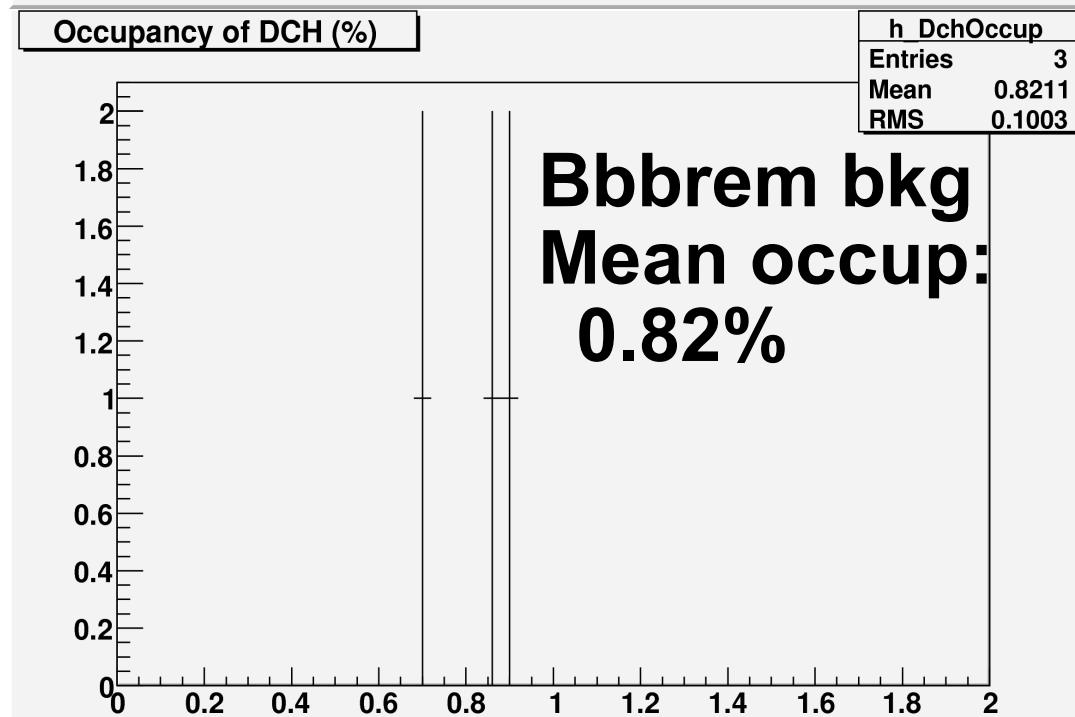
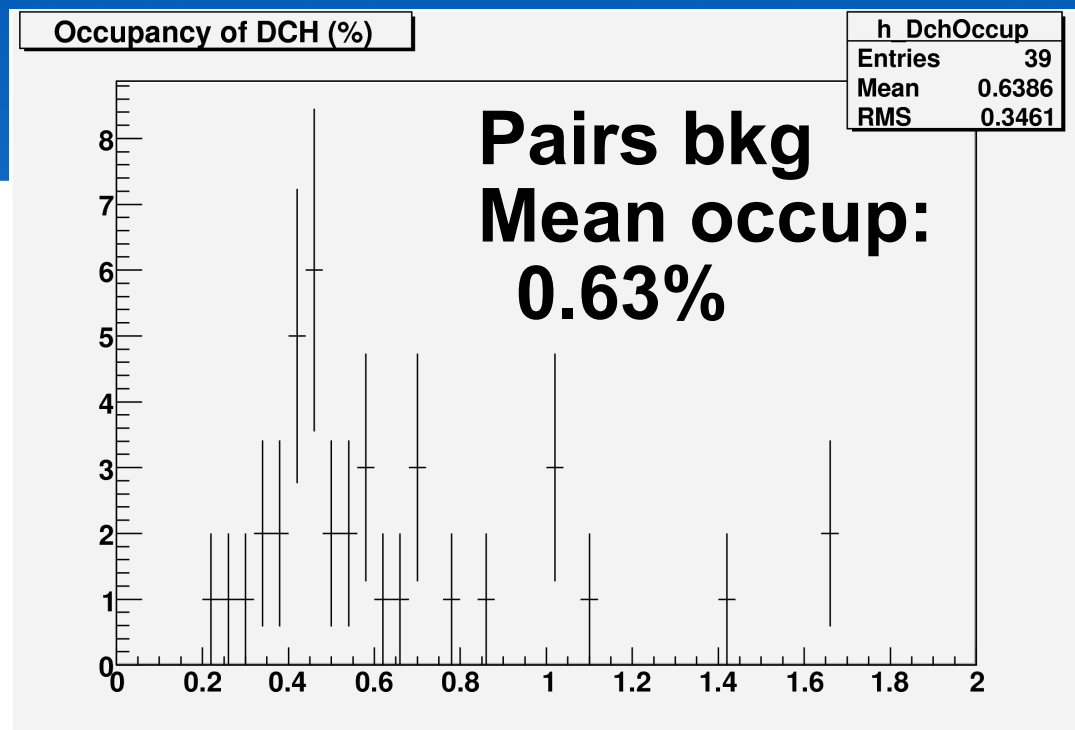
# DCH Results

- Number of cells with energy  $> 0$  during a Daq time slot (1 $\mu$ s)
- No energy threshold

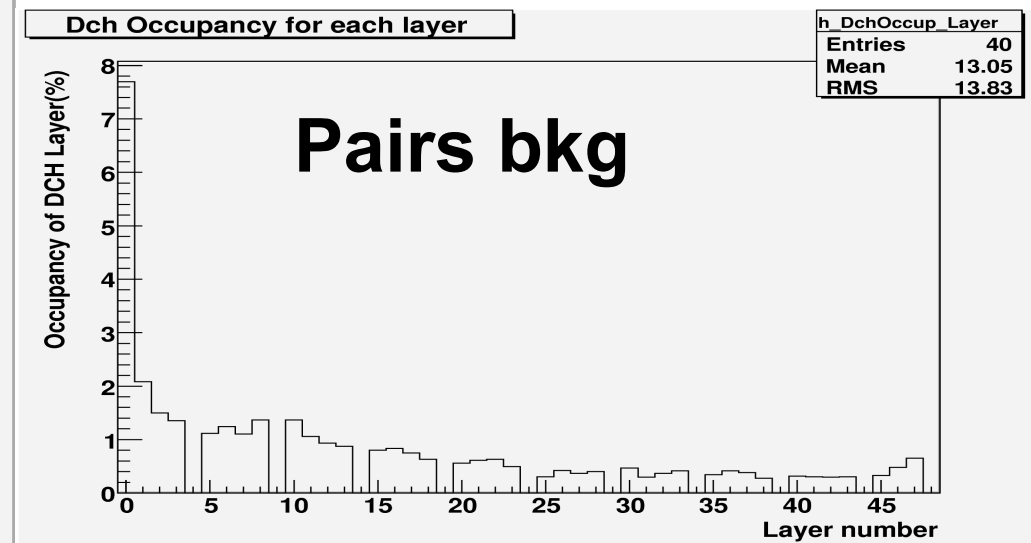
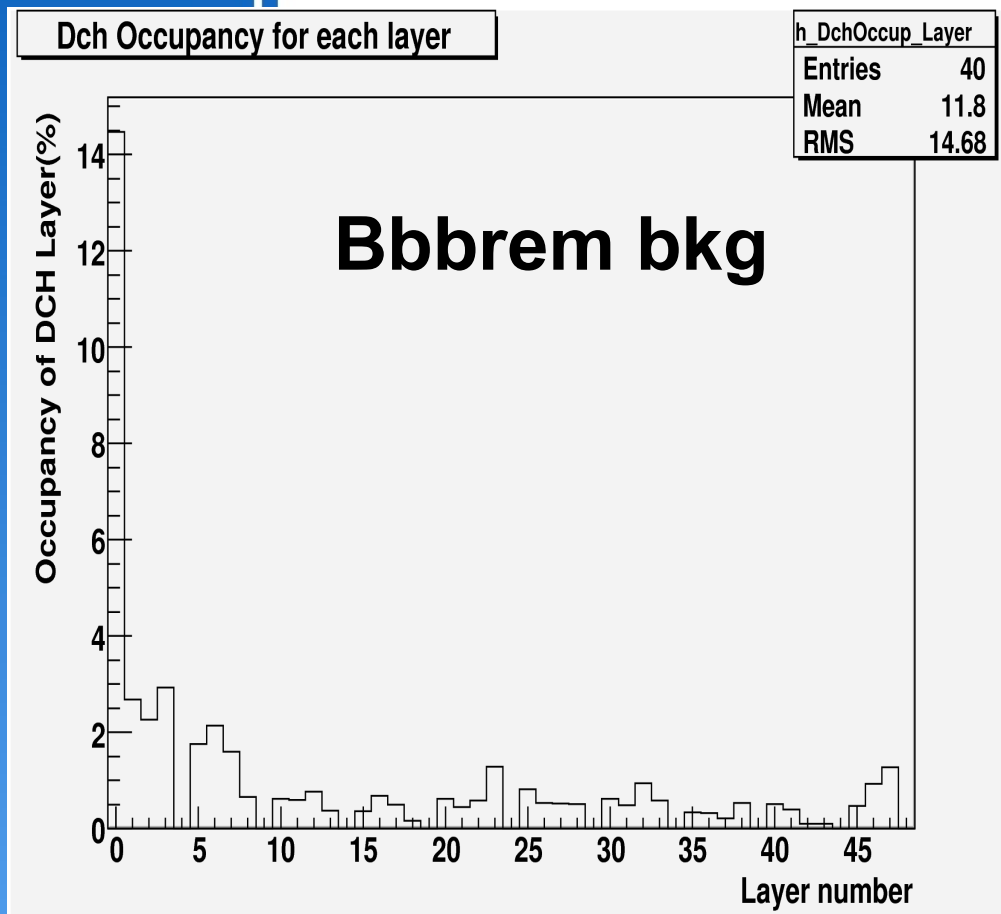


# DCH Results

- Dividing by total number of cells...
- **Occupancy 1.5%**  
(found bug in the code respect to the values shown at Dch Meeting)



# DCH Occupancy per layer



- Occupancy by layer, same y scale
- 22% total on layer 0
- Reasonable occupancy on other layers, not so correlated with  $r$

# Conclusions

- Tools for producing background plots as needed by subsystems
- Easy to get them from Bruno using different bkg types and geometrical configurations
- Some settings (pixel size, Dch structure) are available also after running FullSim
- Results:
  - Background mostly from interaction on chamber wall
  - Occupancy values seem reasonable apart from the first layer (22% total)
- Many requests from people: priority list, but they might look into the code and try to get their own plots

# General Todo List (not in priority order)

- Check geometry at all levels
- DCH
  - Stereo layers
  - Cell shape + staggering (?)
  - Test other geometrical configuration (smaller inner radius, wedding cake end-plate, different tungsten shielding)
- Make a FullSim Production
- Add error bars on bkg quantities
- Other bkg sources, try to embed them into Bruno, if possible
- Clean-up the code and std naming for classes