Forward ECal Occupancy Study & Geometry Redesign Follow-up

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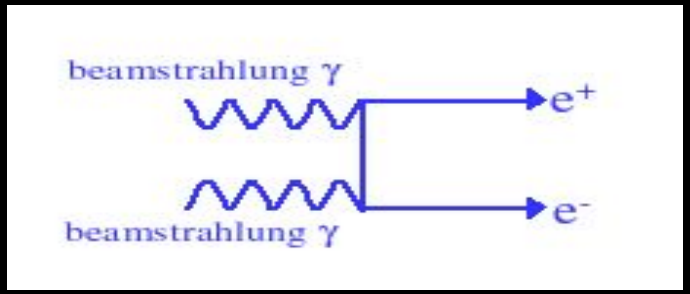
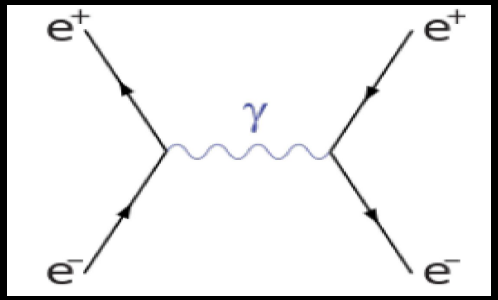
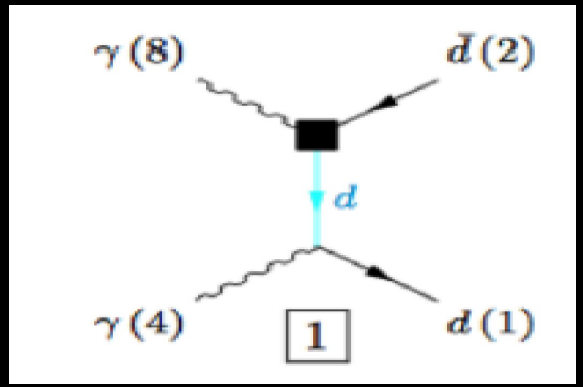
Event Types Included

Pair Backgrounds

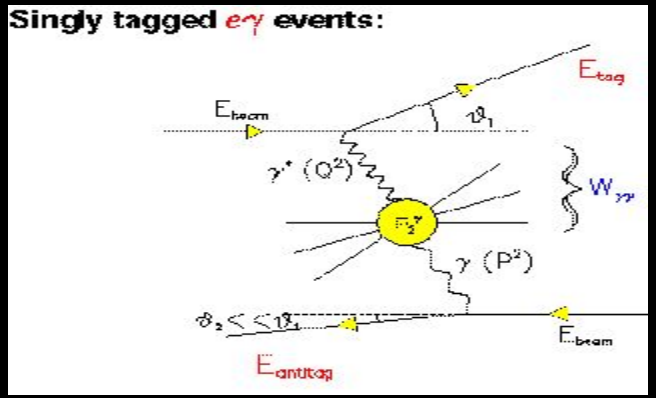


BhaBha





Gamma-gamma to Hadron



Low Cross-section

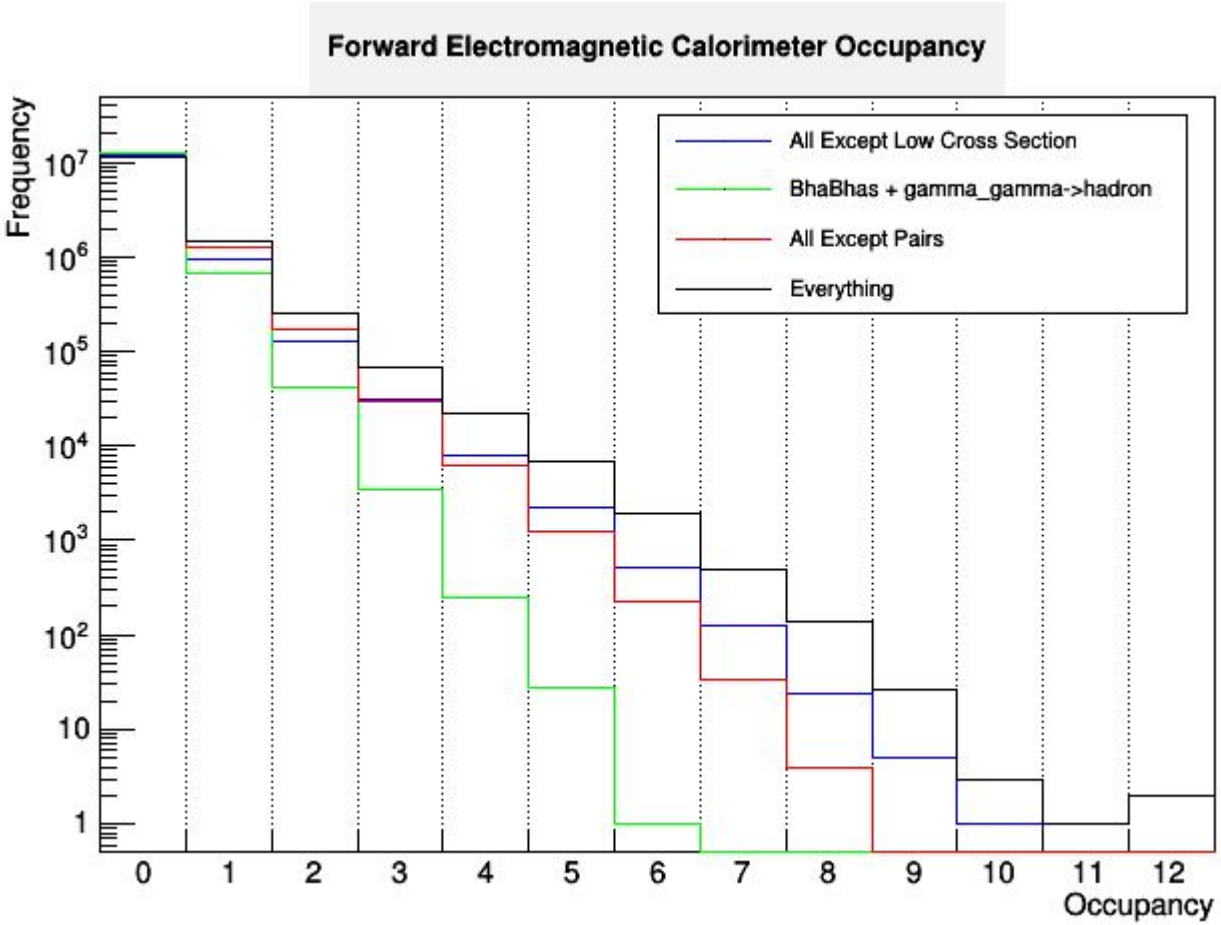
Raw Occupancy: Number of channels across all layers (y-axis) which were hit exactly the given number of times (x-axis), across a luminosity upgrade train's (2624*) worth of bunch crossings.

Note: All other plots are also over a LU train.

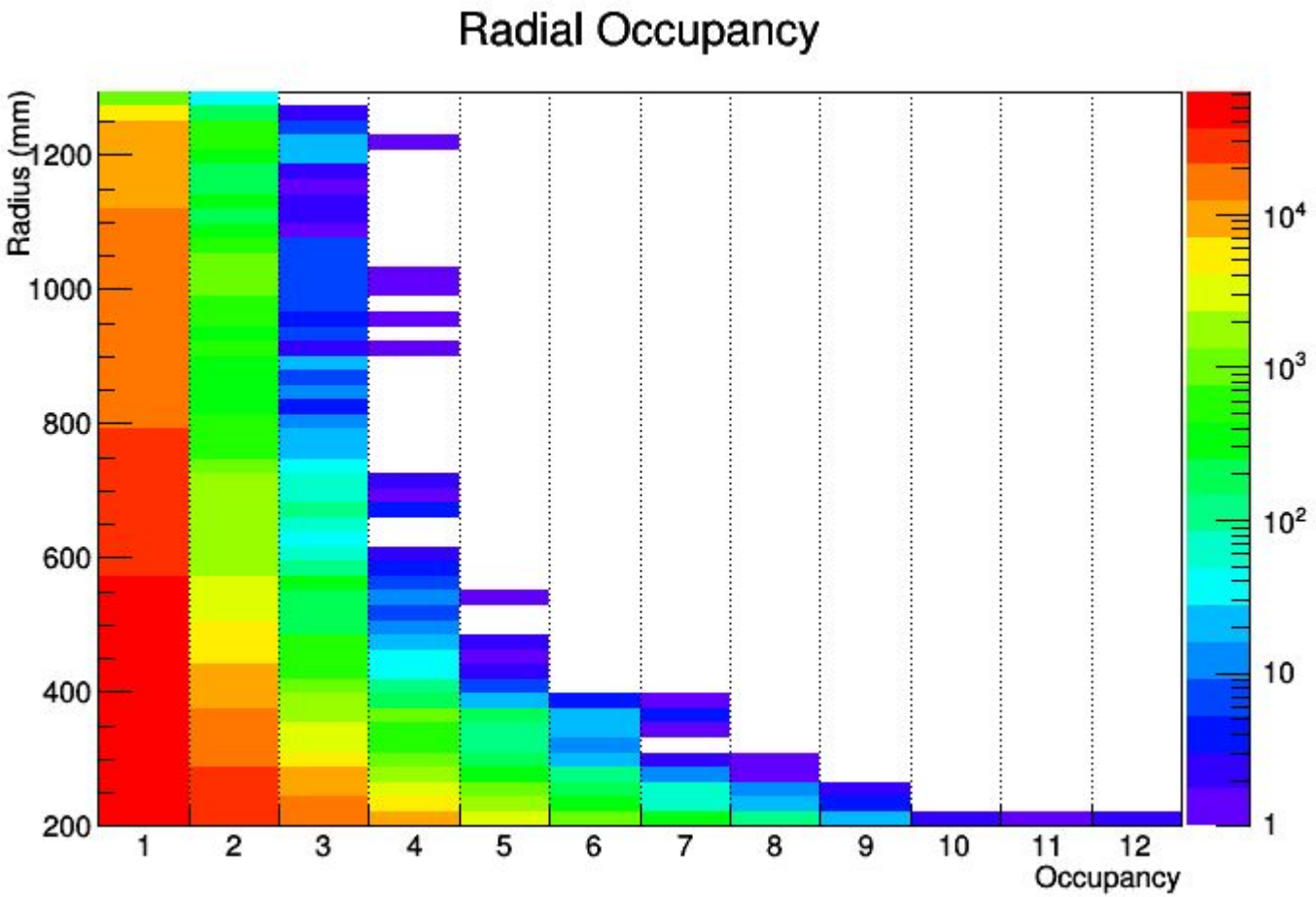
**Individual event rates calculated as:*
$Luminosity_{train} * Cross\_section_{Event}$

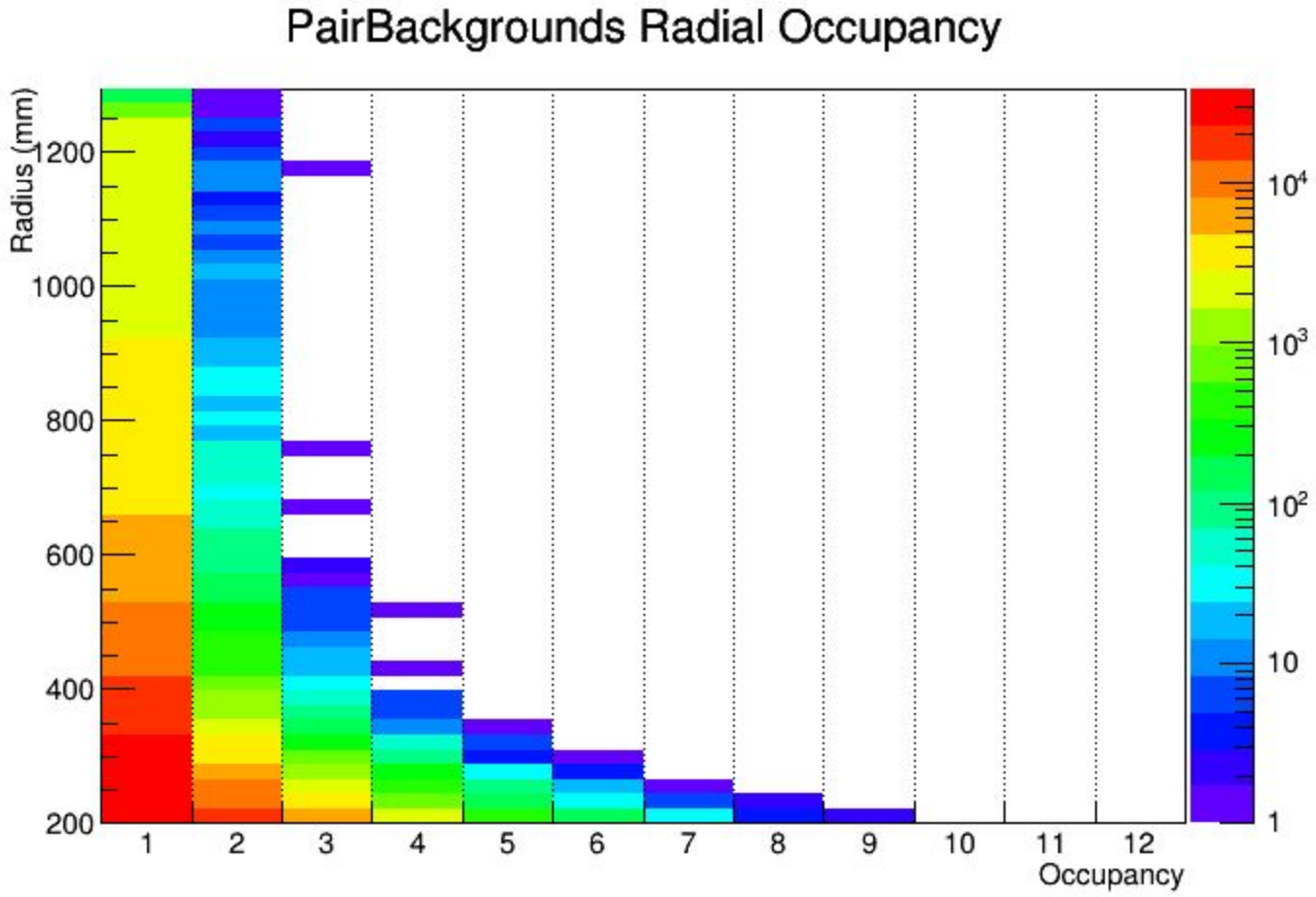
where $Luminosity_{train}$ = *Luminosity/frequency =*
$3.6*10^{-34}\ cm^{-2}\ s^{-1}$ / 5Hz =
$7.2 * 10^{-6}\ fb^{-1}$.

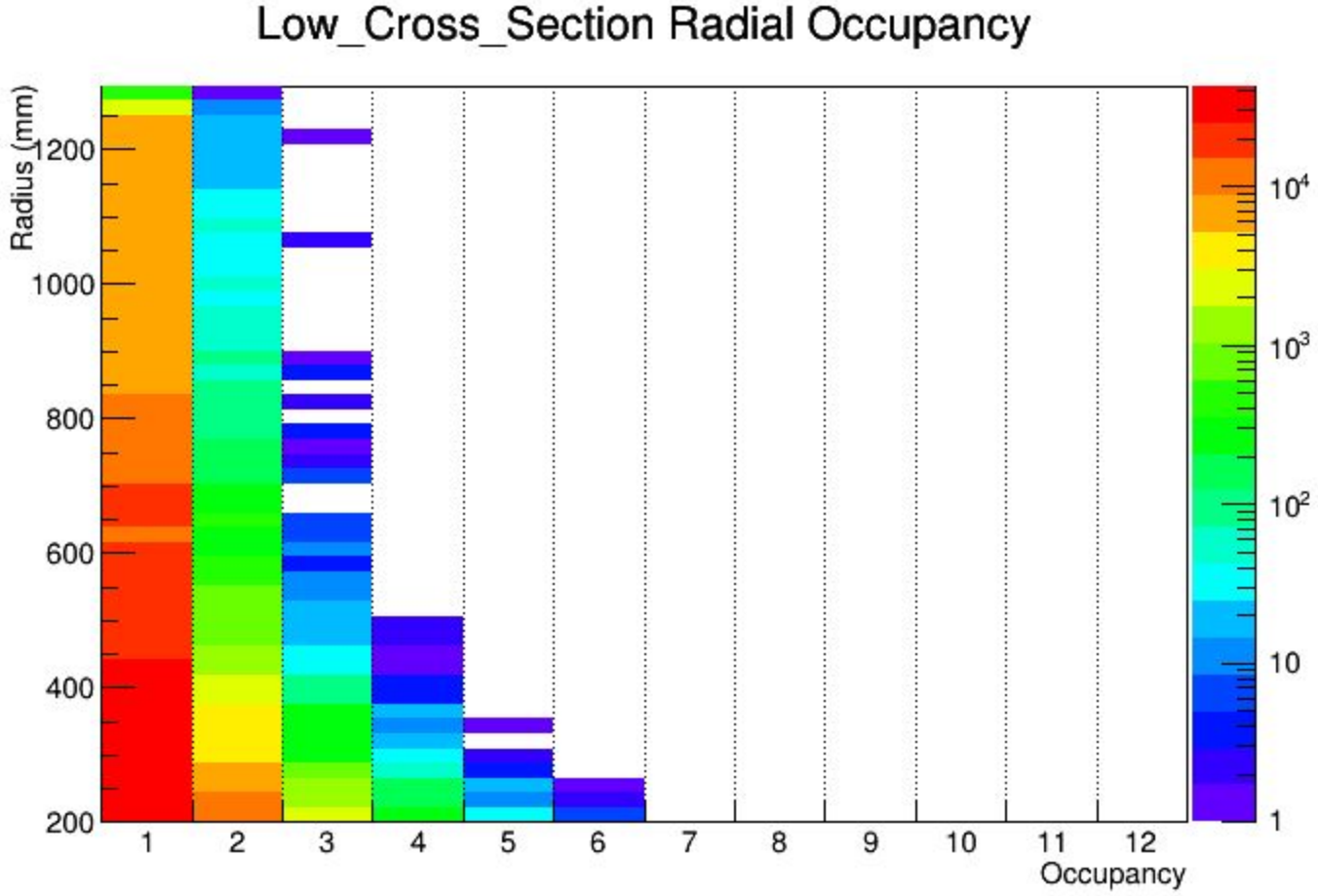
Pairbackgrounds rate was once per bunch crossing

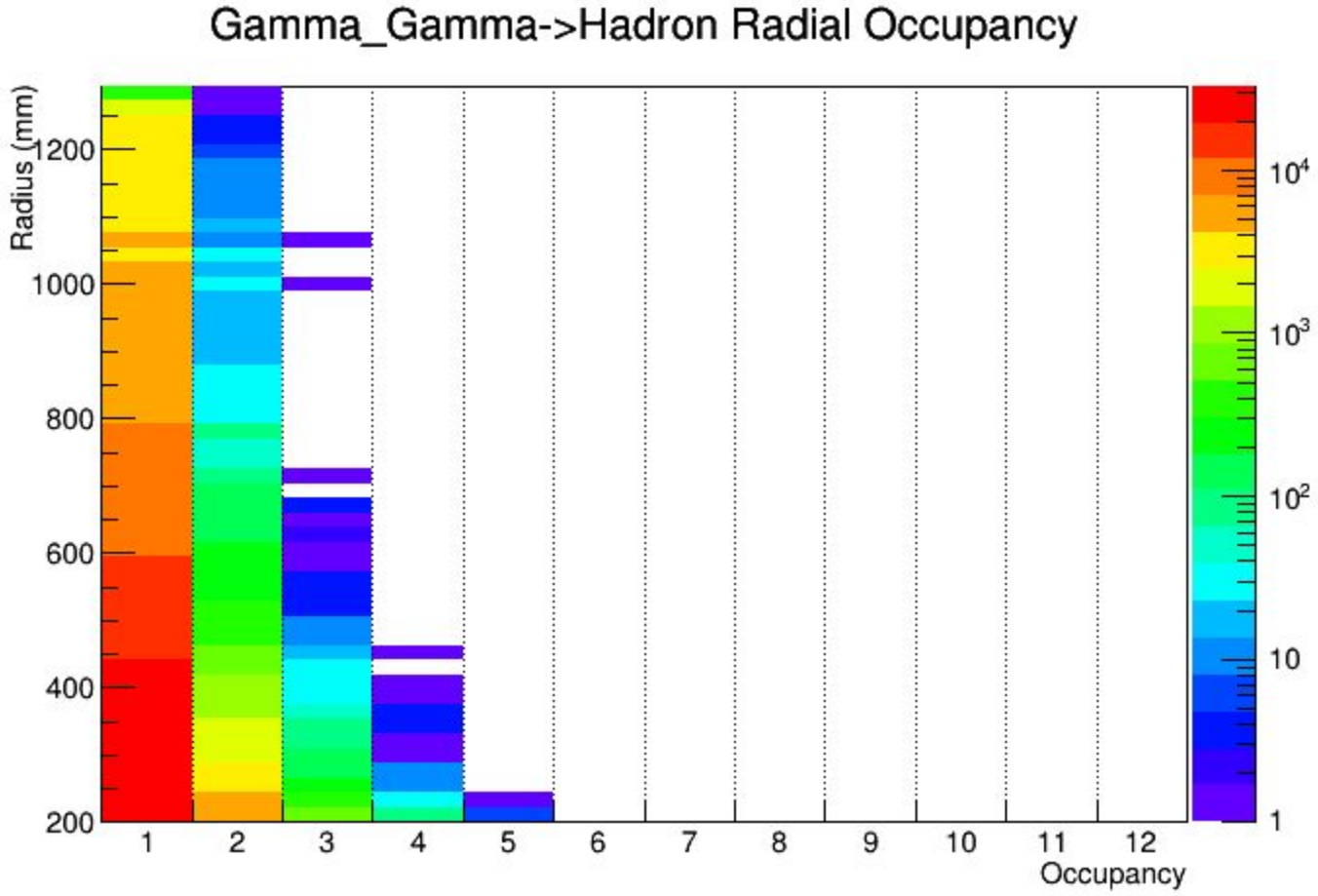


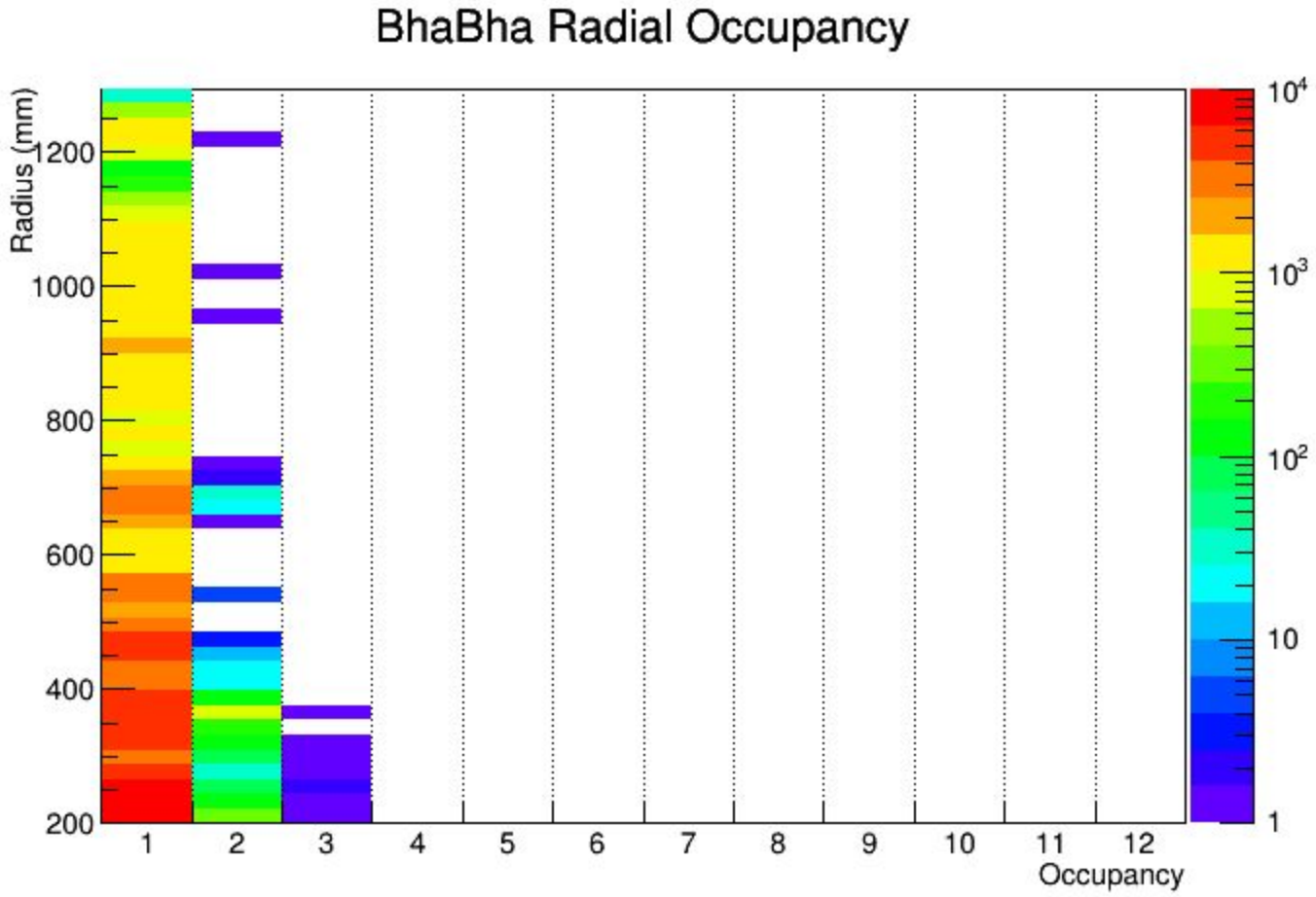
Raw Radial Occupancy:
As before, but with number of channels also now given as a function of radius (channel frequency given by color)



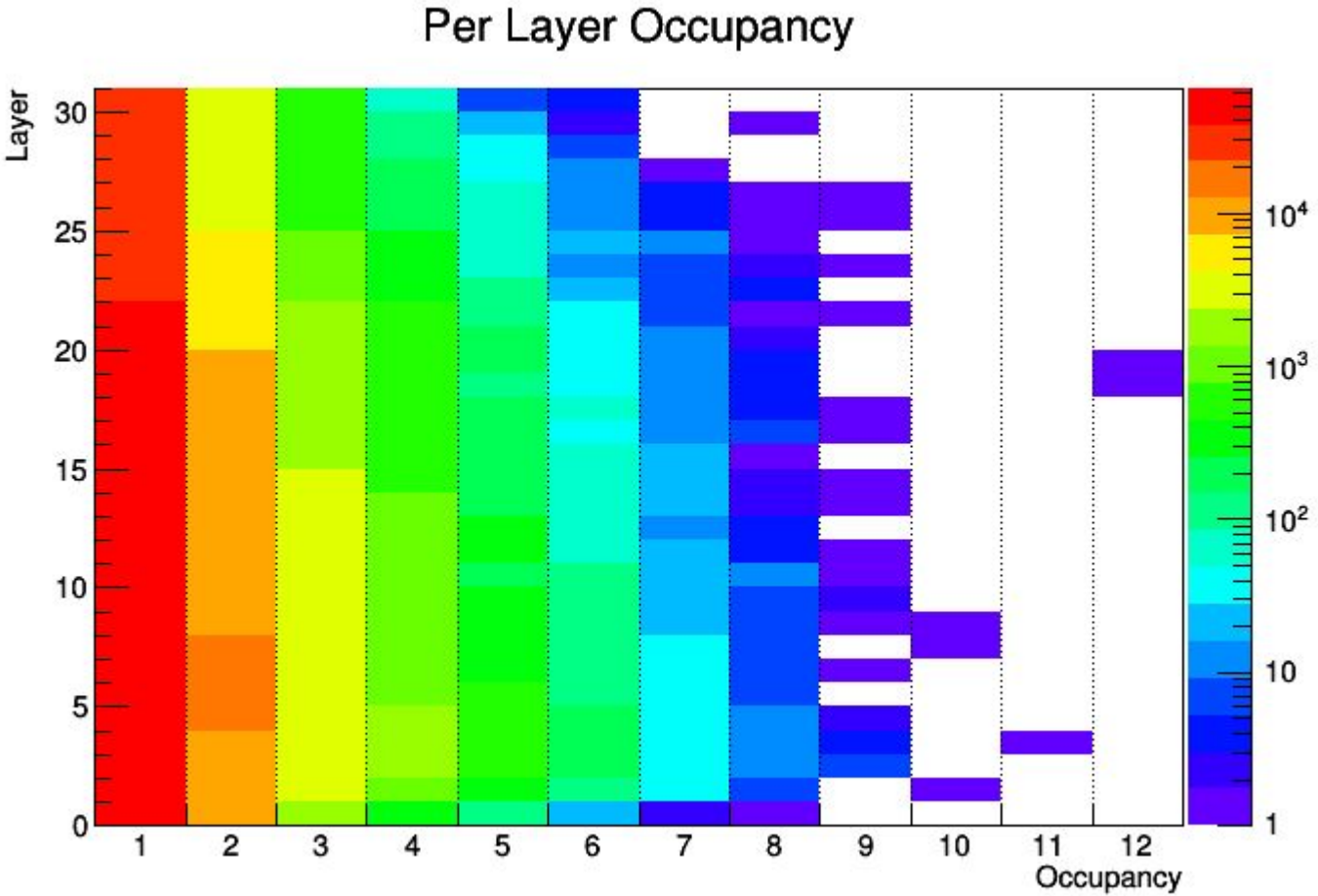

PairBackgrounds Radial Occupancy
Radius (mm)
1200
1000
800
600
400
200
1
2
3
4
5
6
7
8
9
10
11
12
Occupancy
10^4
10^3
10^2
10
1

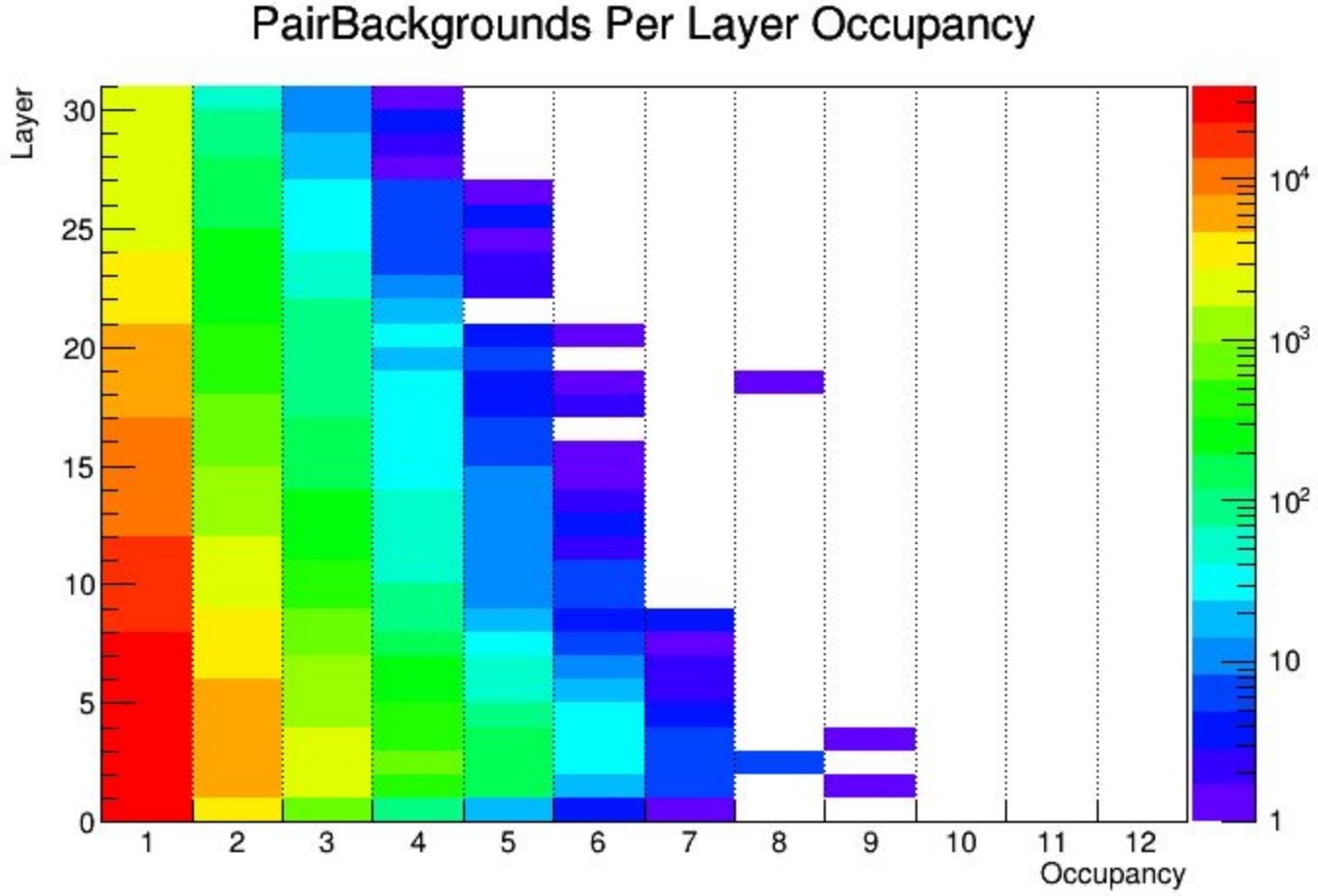

Low_Cross_Section Radial Occupancy
Radius (mm)
1200
1000
800
600
400
200
1
2
3
4
5
6
7
8
9
10
11
12
Occupancy
10^4
10^3
10^2
10
1

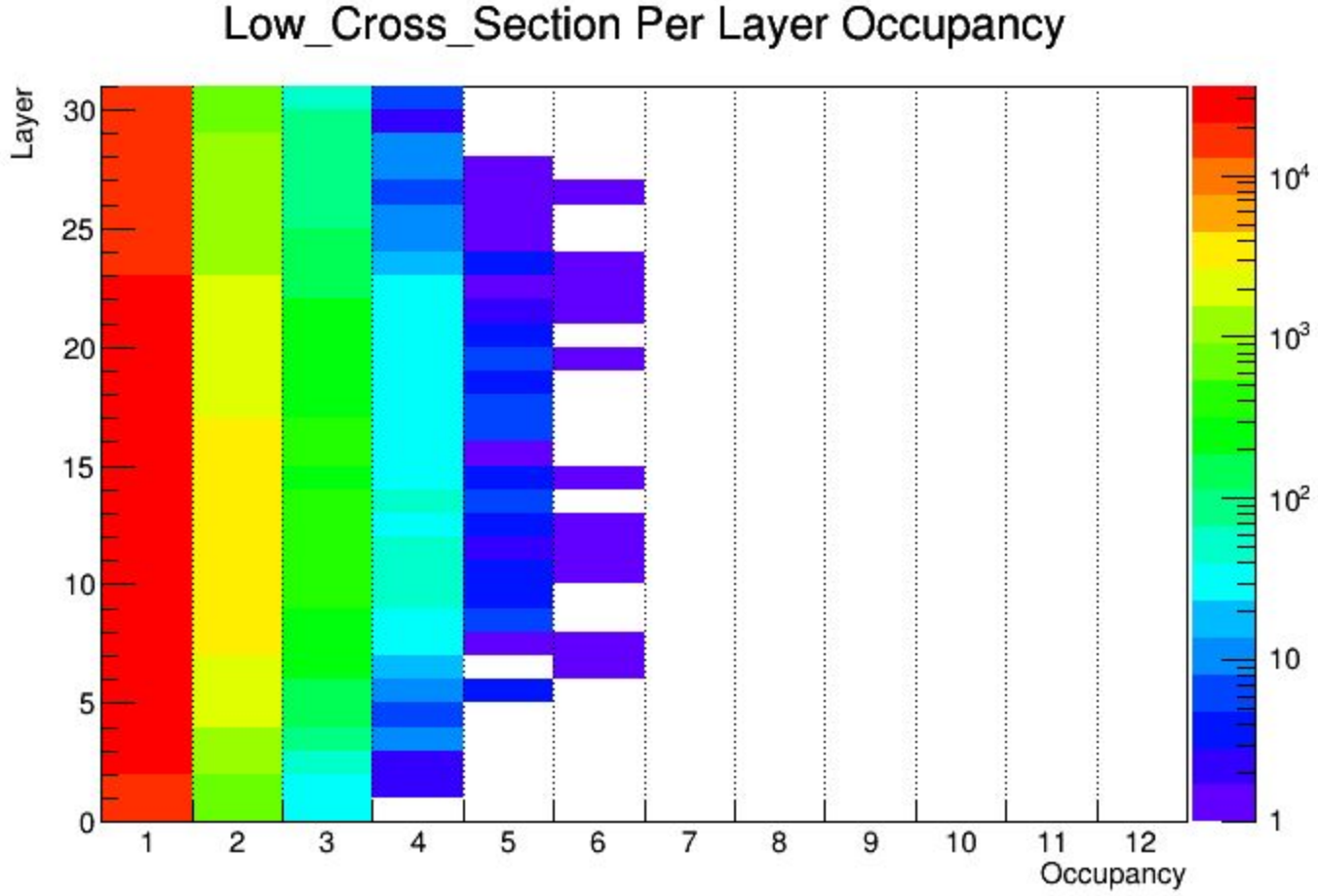

Gamma_Gamma->Hadron Radial Occupancy
Radius (mm)
1200
1000
800
600
400
200
1
2
3
4
5
6
7
8
9
10
11
12
Occupancy
10^4
10^3
10^2
10
1

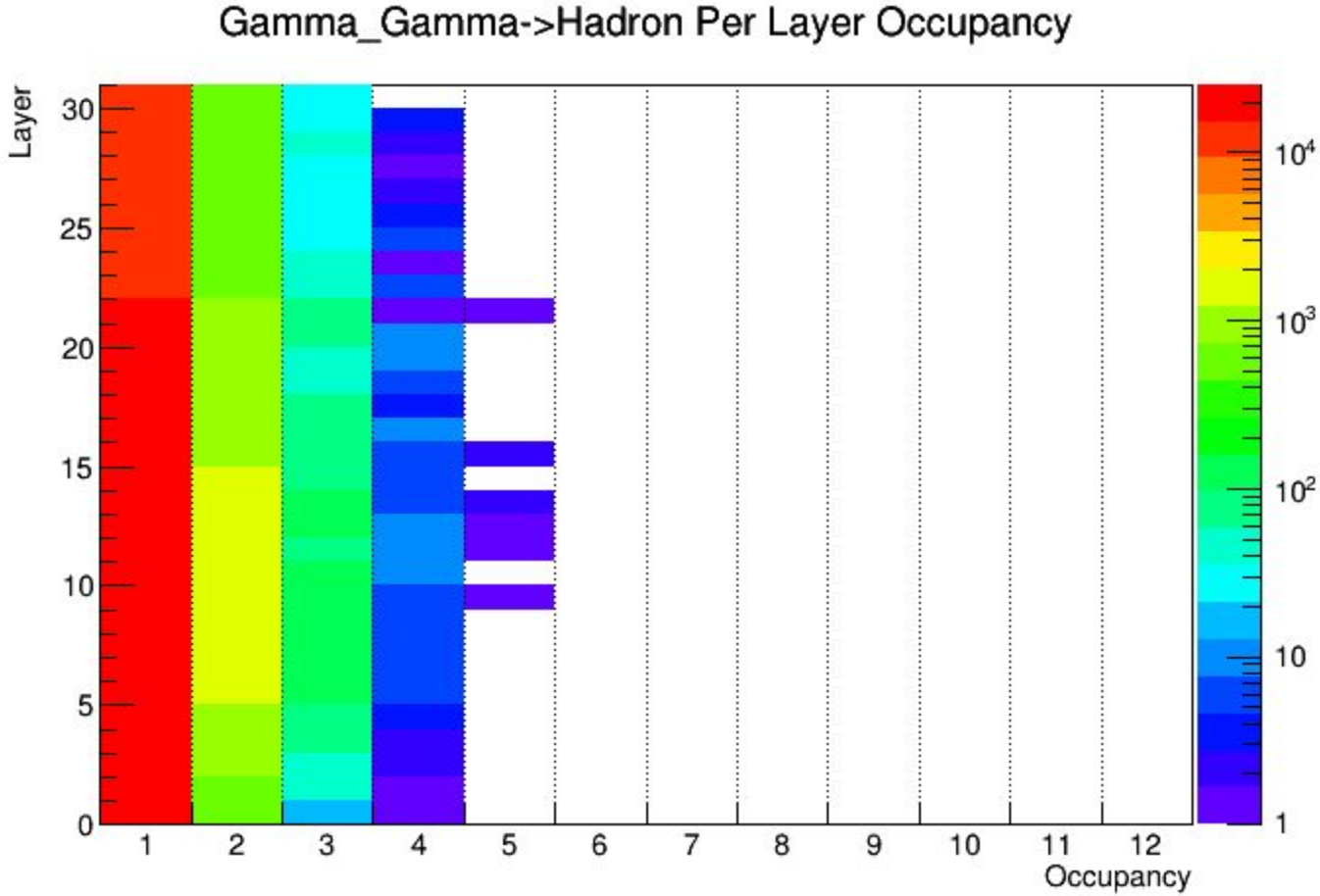

BhaBha Radial Occupancy
Radius (mm)
1200
1000
800
600
400
200
1
2
3
4
5
6
7
8
9
10
11
12
Occupancy
10^4
10^3
10^2
10
1

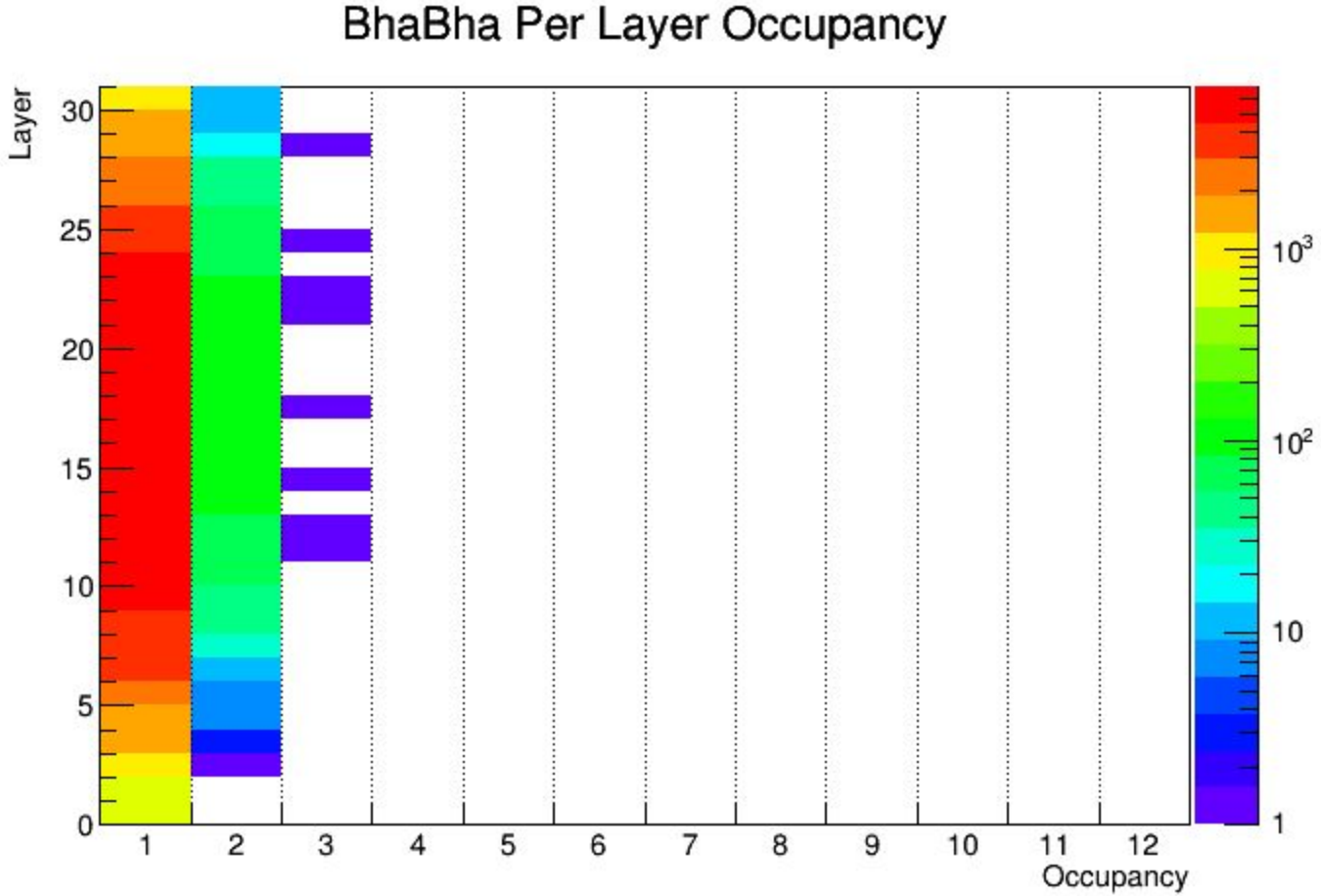
Raw Layer Occupancy:
As before, but with number of channels also now given as a function of layer (channel frequency given by color)



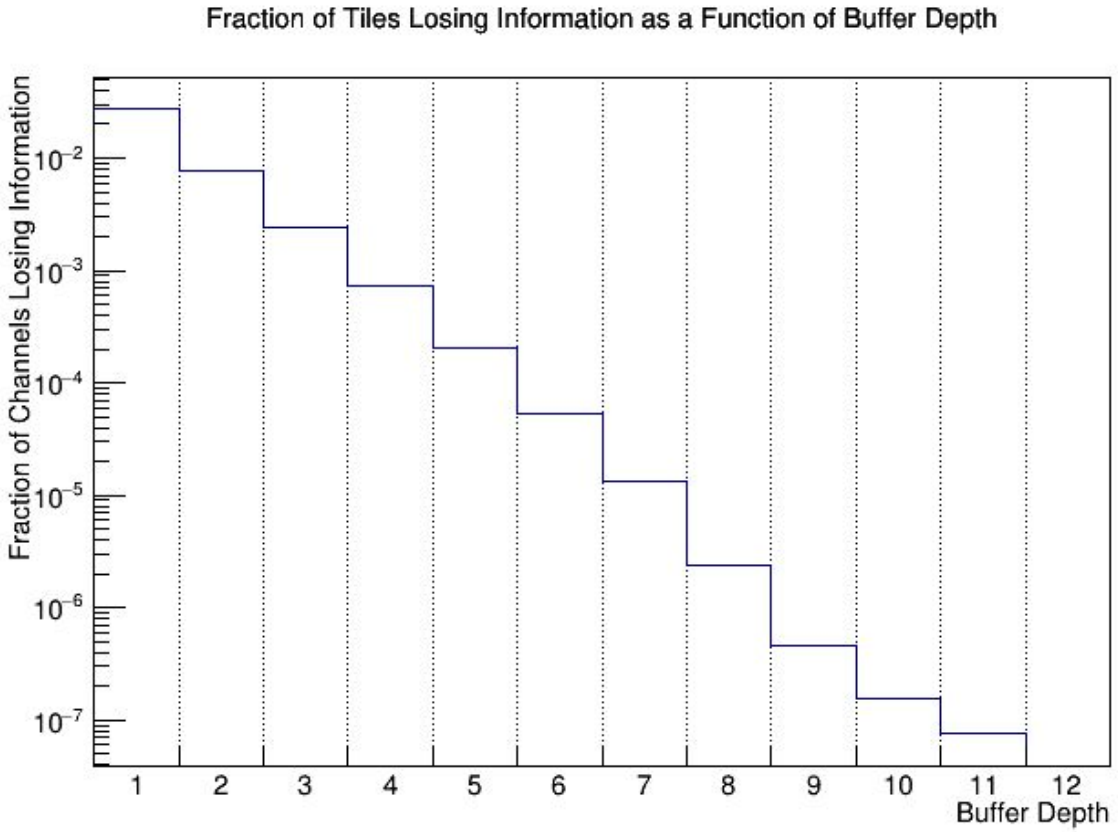

PairBackgrounds Per Layer Occupancy
Layer
30
25
20
15
10
5
0
1
2
3
4
5
6
7
8
9
10
11
12
Occupancy
10^4
10^3
10^2
10
1


Low_Cross_Section Per Layer Occupancy
Layer
30
25
20
15
10
5
0
1
2
3
4
5
6
7
8
9
10
11
12
Occupancy
10^4
10^3
10^2
10
1

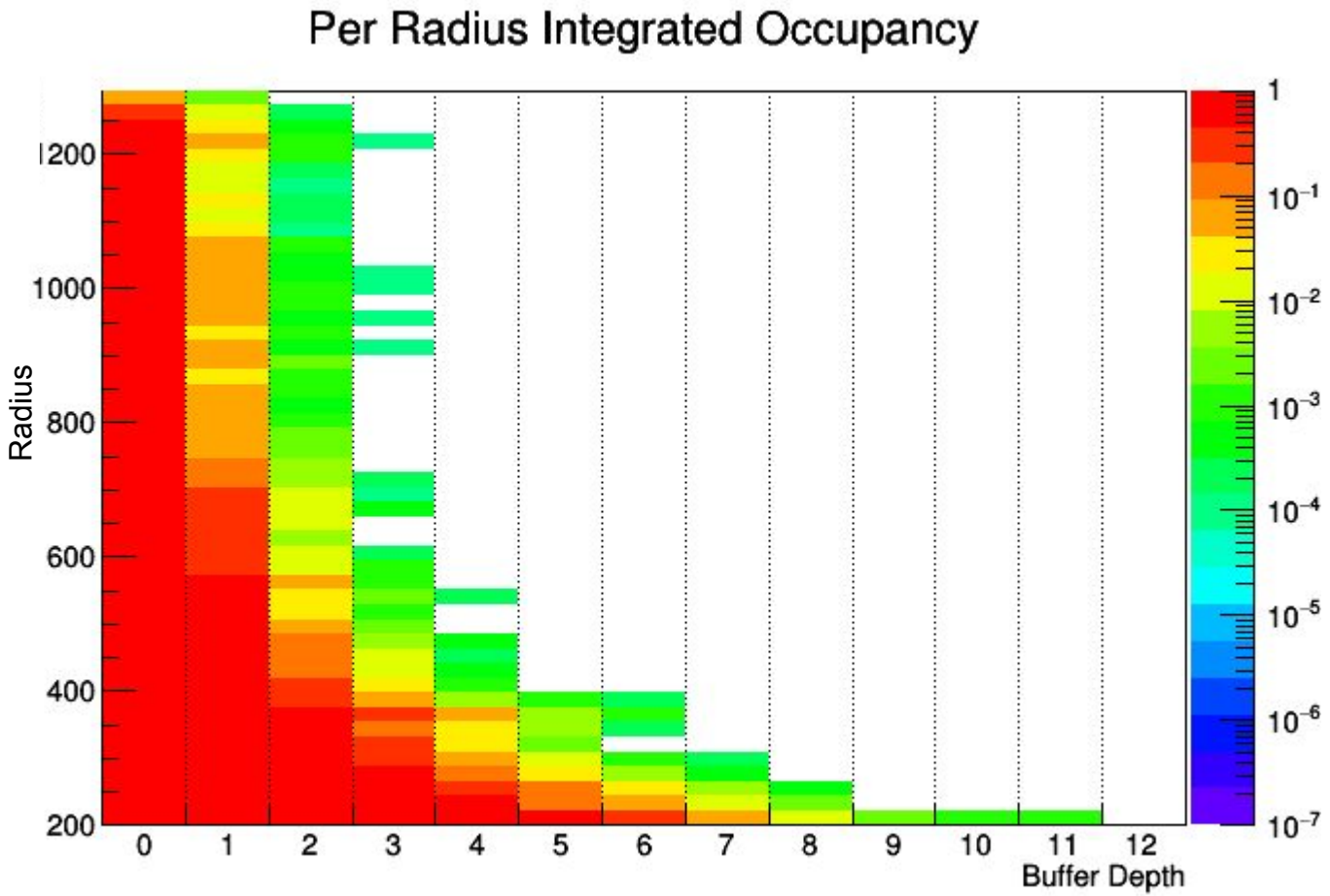

Gamma_Gamma->Hadron Per Layer Occupancy
Layer
30
25
20
15
10
5
0
1
2
3
4
5
6
7
8
9
10
11
12
Occupancy
10^4
10^3
10^2
10
1


BhaBha Per Layer Occupancy
Layer
30
25
20
15
10
5
0
1
2
3
4
5
6
7
8
9
10
11
12
Occupancy
10^3
10^2
10
1

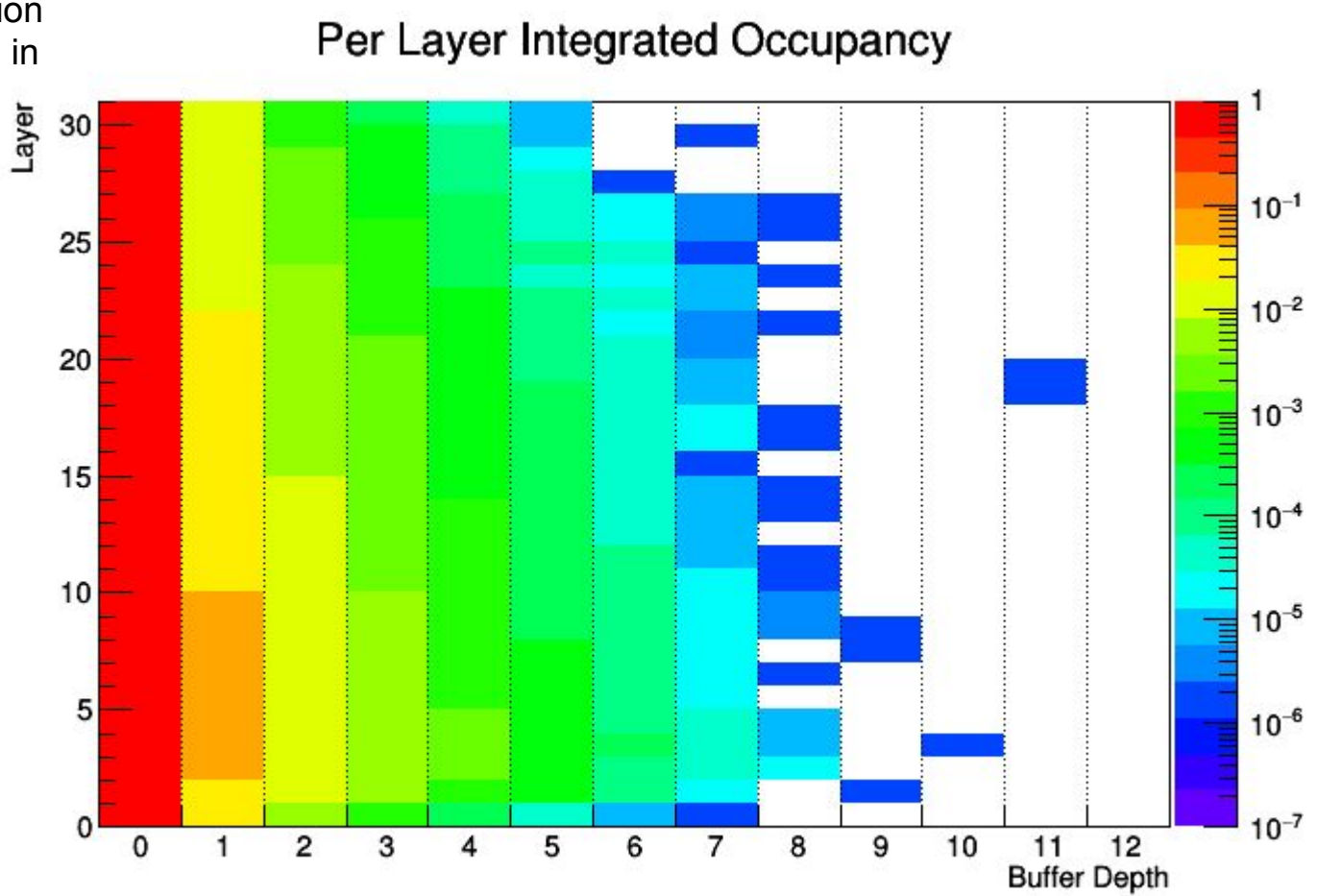
Integrated Occupancy / Buffer Depth: The i^{th} bin contains the fraction of channels which were hit ‘i’ times *or more*. i.e. bin 2 contains the fraction of channels hit 2 times plus the fraction hit 3 times plus … plus the fraction hit 12 times.



Radial Integrated Occupancy: Like the previous plot, but as a function of radius, with the fraction given in color



Layer Integrated Occupancy: Like the previous plot, but as a function of radius, with the fraction given in color

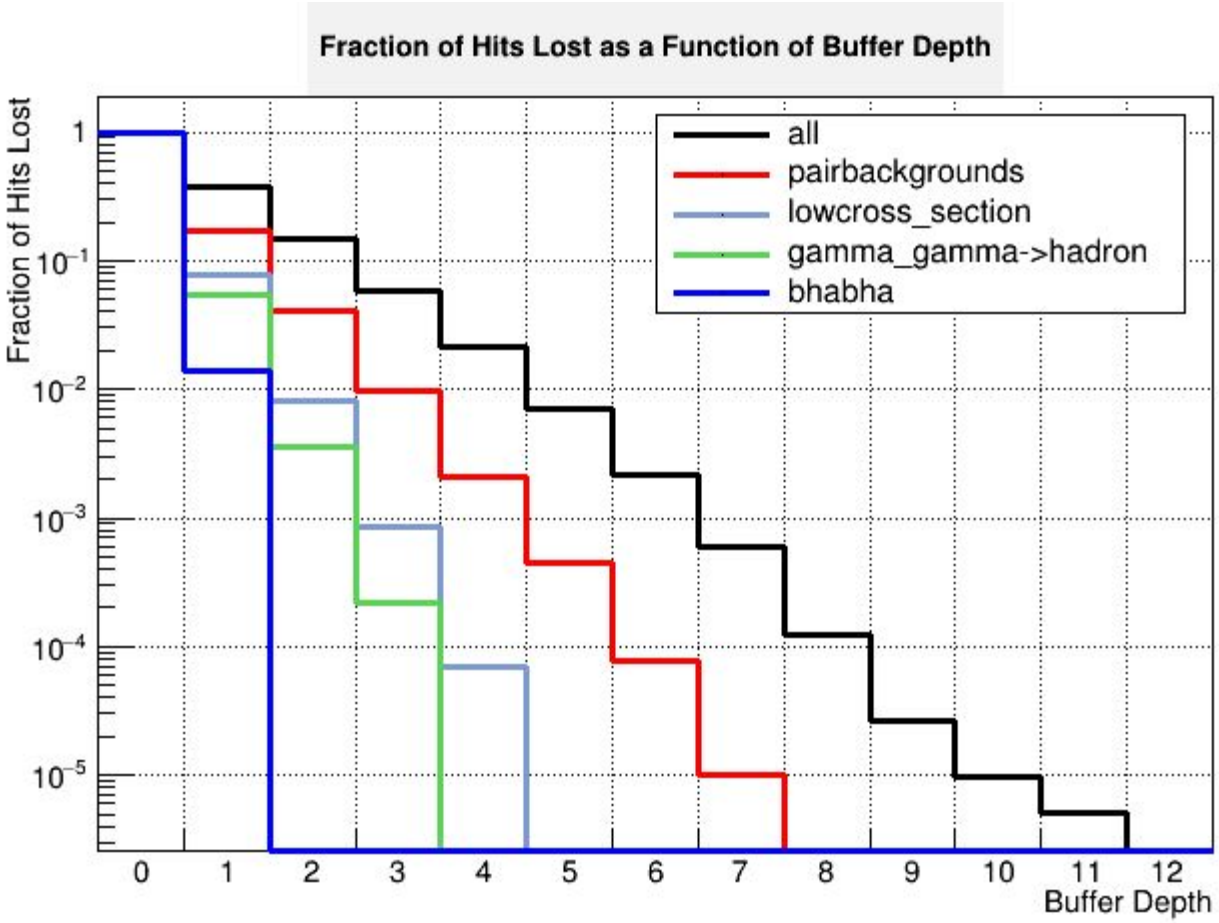


Weighted Integrated Occupancy:
The i^{th} bin contains the number of *hits* that are lost with a given buffer depth. Specifically,

$$Bin_{i-1} = \sum_{j=i}^{12} [(frequency_i)^* (j-i+1)] / totalHits$$

where frequency is the number of times a channel received *i* number of hits.
So ($frequency_i * i$) equals the number of times the channel was hit.

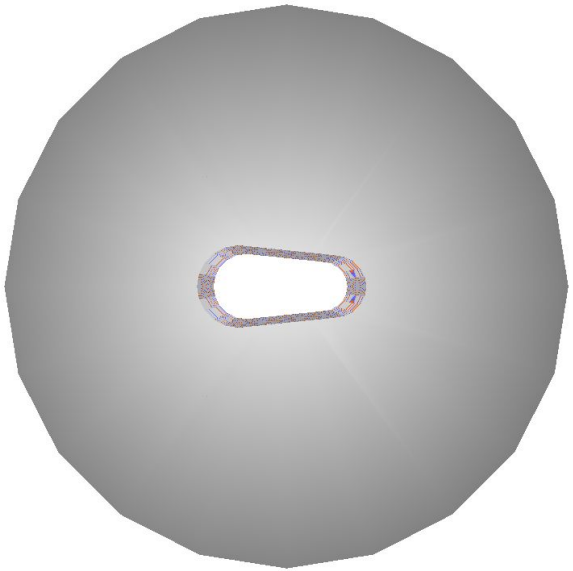
note: The individual event types do NOT add linearly.



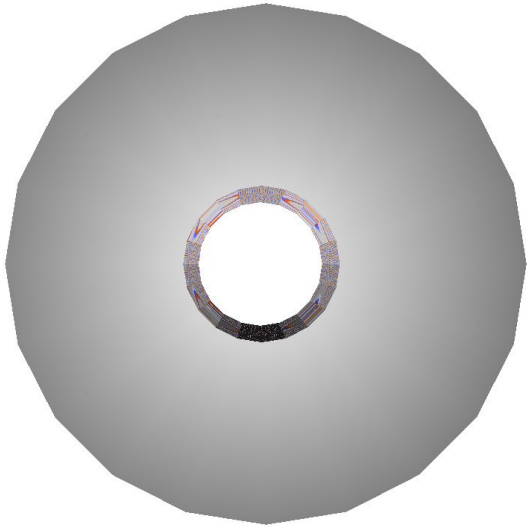
Geometry Redesign Follow Up

Tested BeamCal Reconstruction Efficiency and Vertex Endcap/Barrel Occupancy with BeamCal Plug Region removed, and with anti-did field

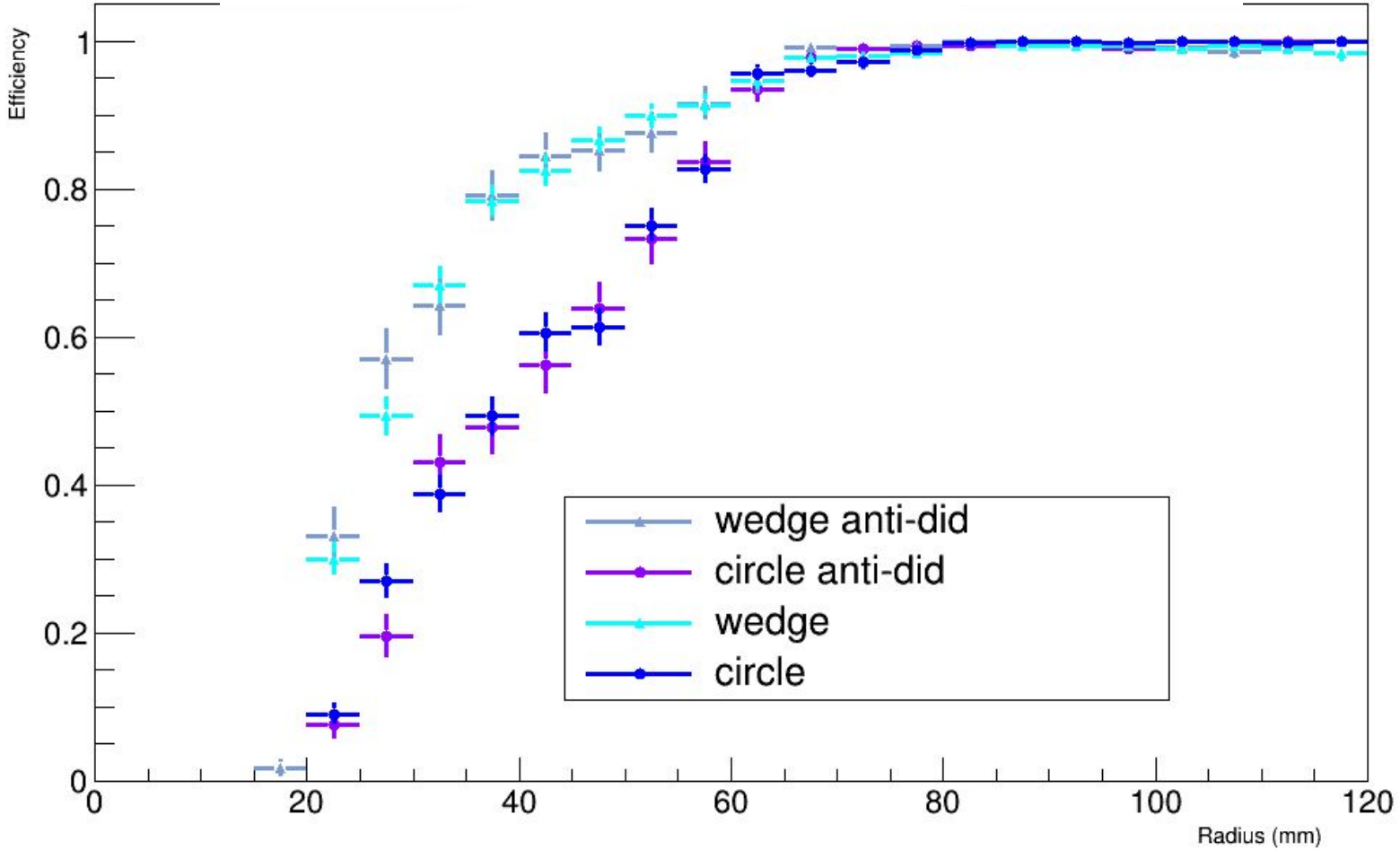
Wedge

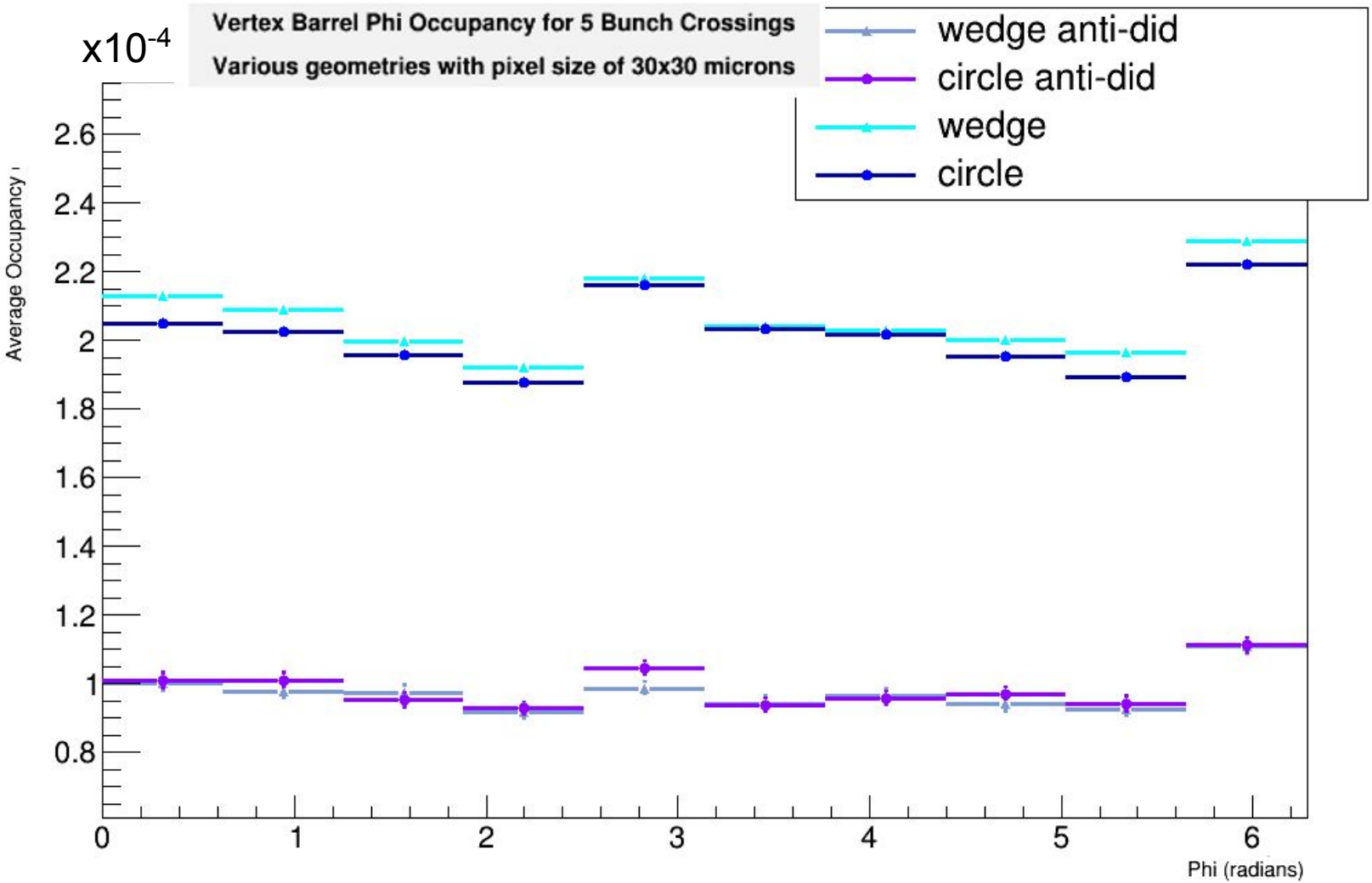


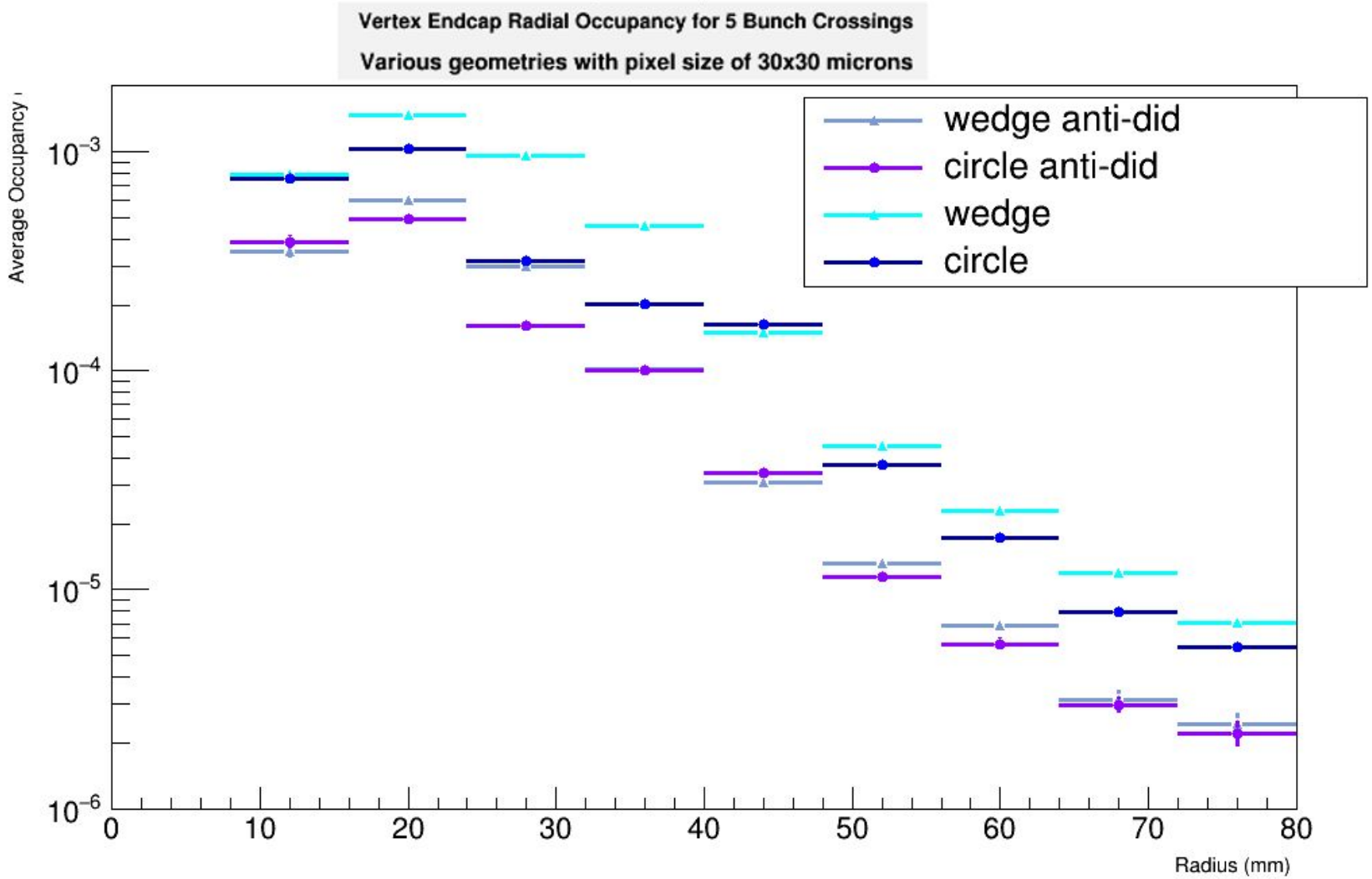
Circle



BeamCal Total Reconstruction Efficiency




Vertex Barrel Phi Occupancy for 5 Bunch Crossings
Various geometries with pixel size of 30x30 microns
x10-4
wedge anti-did
circle anti-did
wedge
circle
Average Occupancy
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0
1
2
3
4
5
6
Phi (radians)


Vertex Endcap Radial Occupancy for 5 Bunch Crossings
Various geometries with pixel size of 30x30 microns
wedge anti-did
circle anti-did
wedge
circle
Average Occupancy
10^{-3}
10^{-4}
10^{-5}
10^{-6}
0
10
20
30
40
50
60
70
80
Radius (mm)