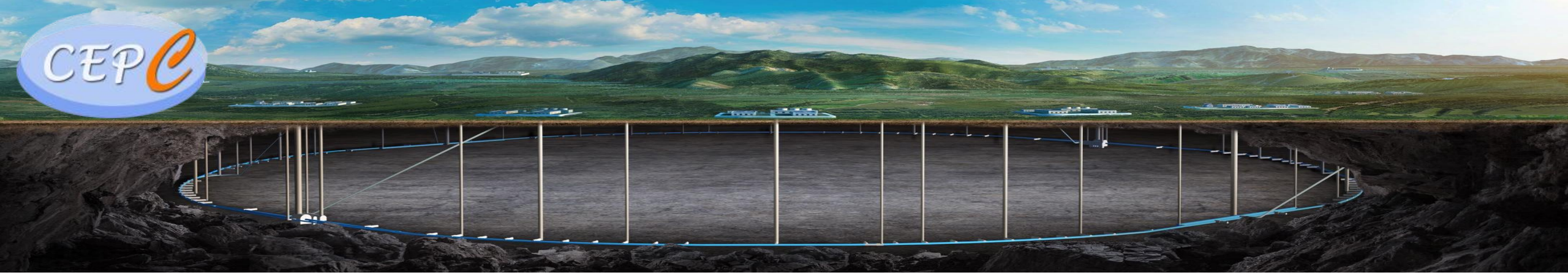

Beam background on physics performance

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Introduction

- **Only for Higgs run (CEPCSW_tdr25.5.0)**

  Beam background simulation from Haoyu Shi

  There was a dedicated discussion **yesterday** about how to present the characteristic number of the bkg rate. The simulation is still considered safe for now.

  Synchrotron Raidation simulation is not avaliable.

  Double the pair productuin to mimic the SR [for VXD]. No special treatment for other sub-detectors. **[follow TDR]**

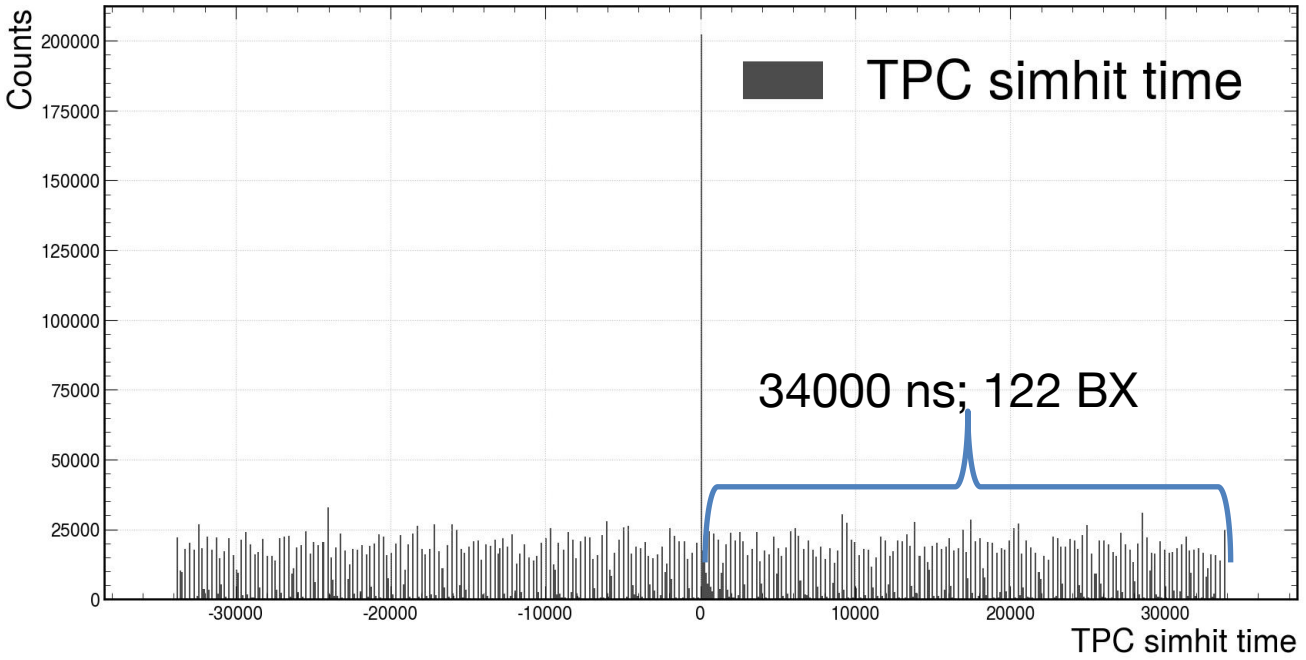
- **Time windows for sub-detectors**

  VXD : 200 ns; ITK : 30 ns

  TPC : 34000 ns; OTK : 30 ns

  ECAL : 150 ns; HCAL : 1000 ns

	50MW Higgs, 277ns/BX
Pair Production	~1.82 GHz in IR
Beam Thermal Photon	~0.3 kHz/beam in IR
Beam Gas Bremsstrahlung	~4.1 kHz/beam in IR
Beam Gas Coulomb	~87.8 kHz/beam in IR
Touschek Scattering	~0.3 kHz/beam in IR

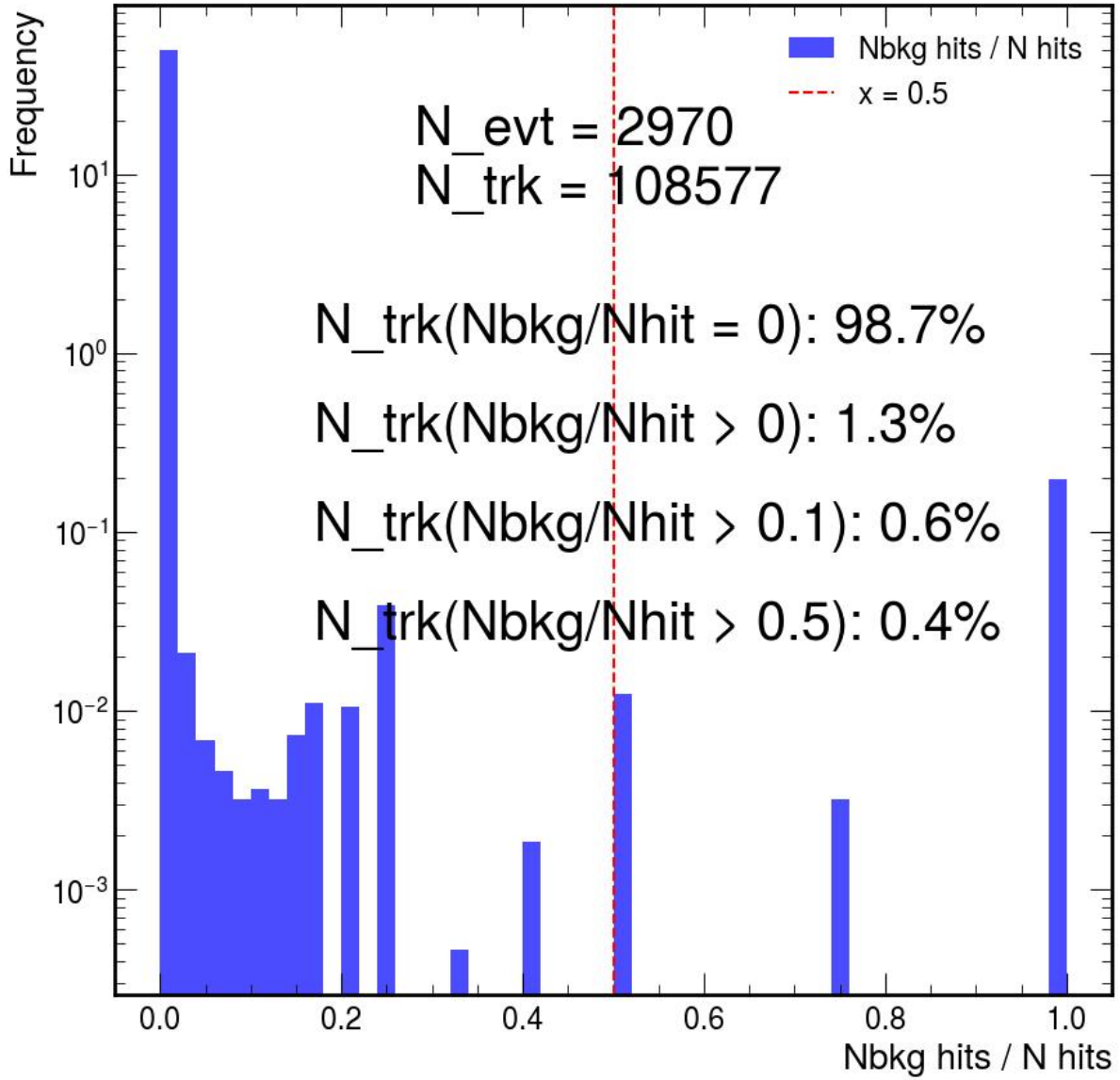


Introduction

- Before diving in, it's a good ideal to check whether the dose of background is sufficient, to ensure that my results make sence.

Ave. Hit Rate @ H run [MHz/cm^2]	My result	TDR-Draft-v0.5.0	
VXD-L1	2.5	2.5	
L2	0.66	0.67	
L3	0.17	0.17	
L4	0.066	0.078	
L5	0.021	0.018	
L6		0.085	
ITK-Barrel-L1	0.72	0.64	I treat the ITK barrel layers as cylinder, so the area is smaller
L2	0.69	0.49	
L3	0.57	0.36	

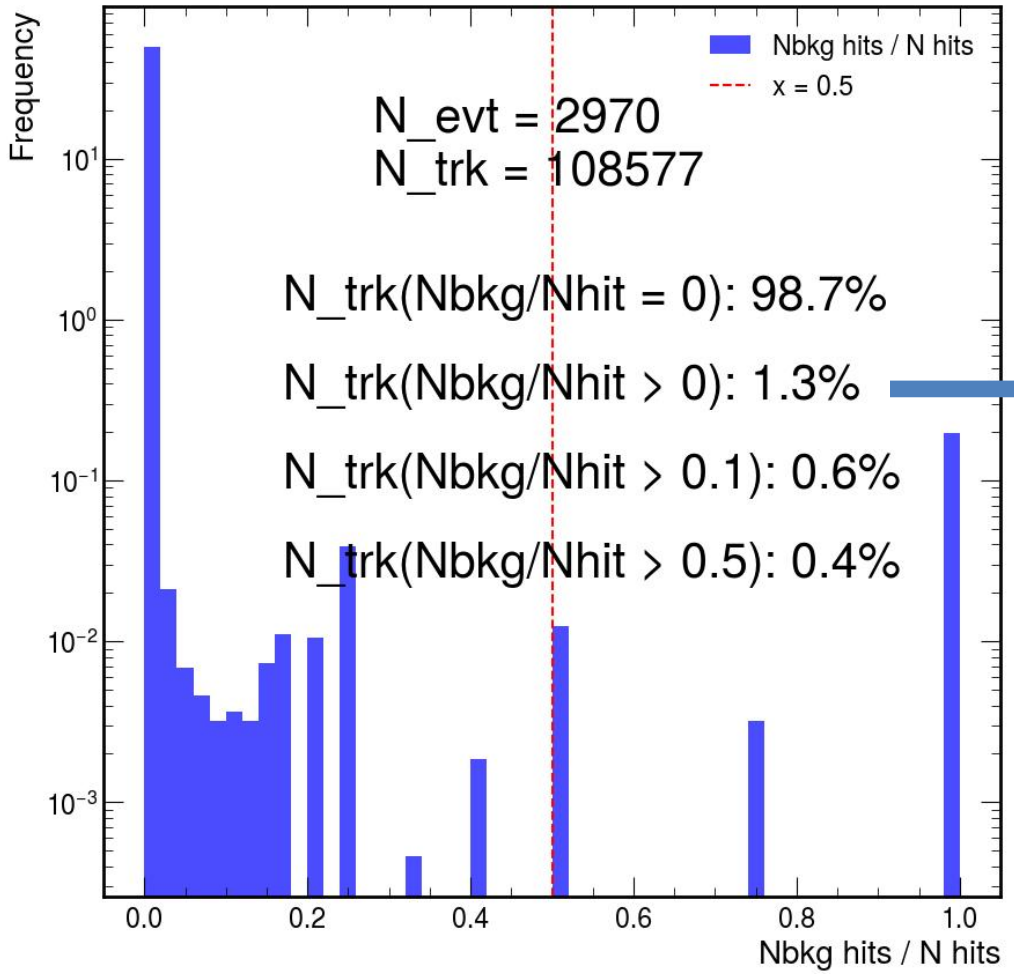
Tracking



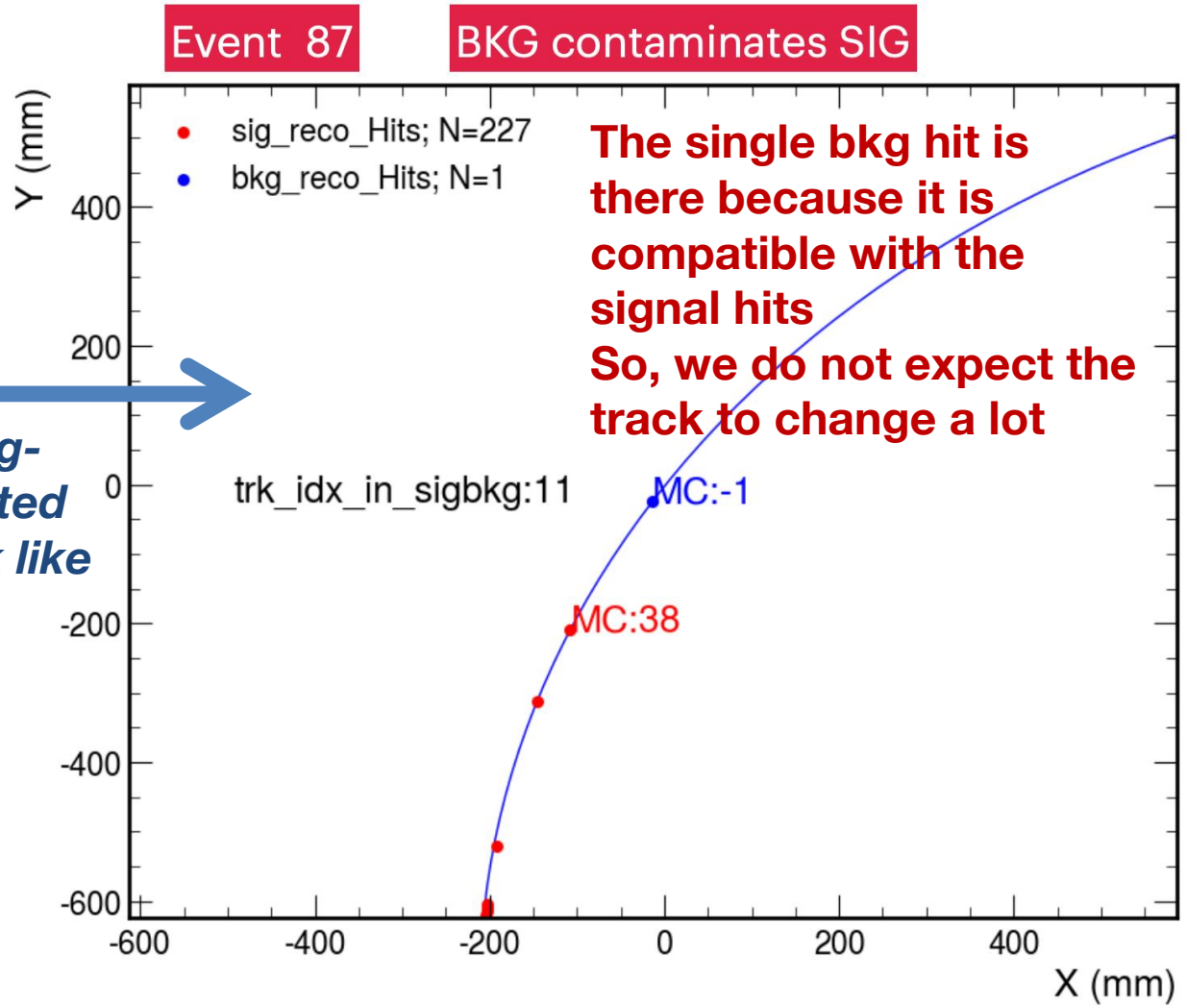
- ee->ZH, Z->vv, H->gg events are mixed with brackground
- bkg_fraction = $\frac{\text{the number of bkg hits in a track}}{\text{the total number of hits in a track}}$

- **98.7%** of the tracks have **NO background hits**
- 1.3% of the tracks are contaminated by the background, but half of them have a bkg_frac < 0.1%

Tracking

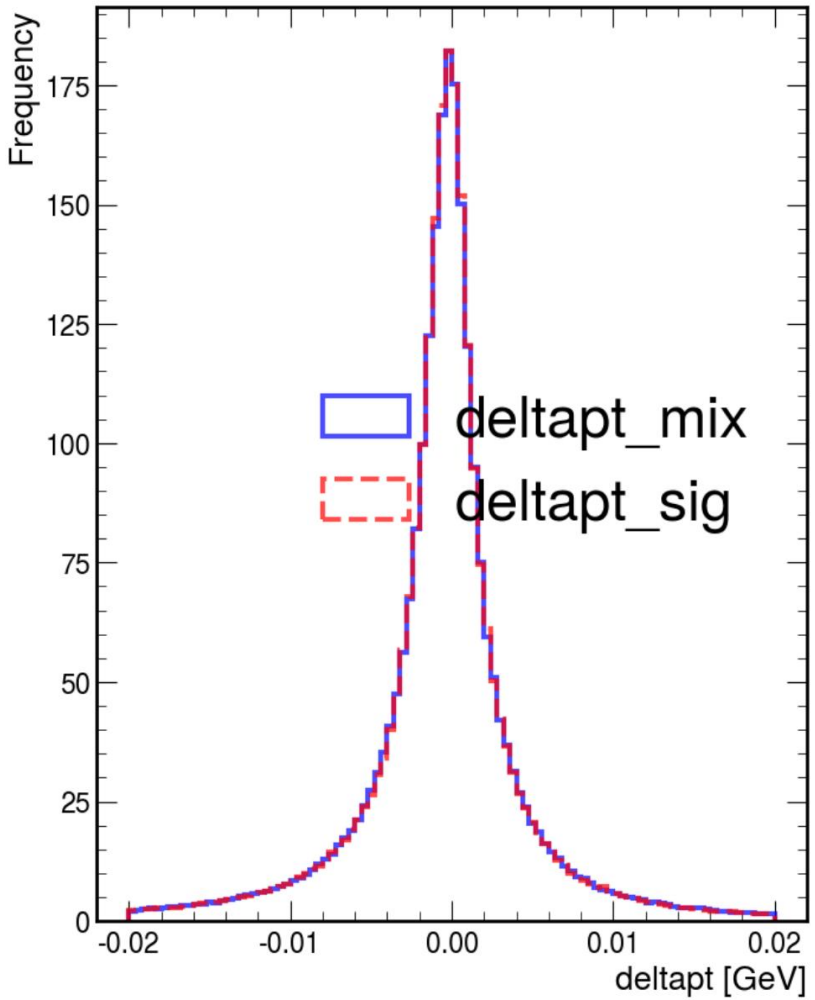


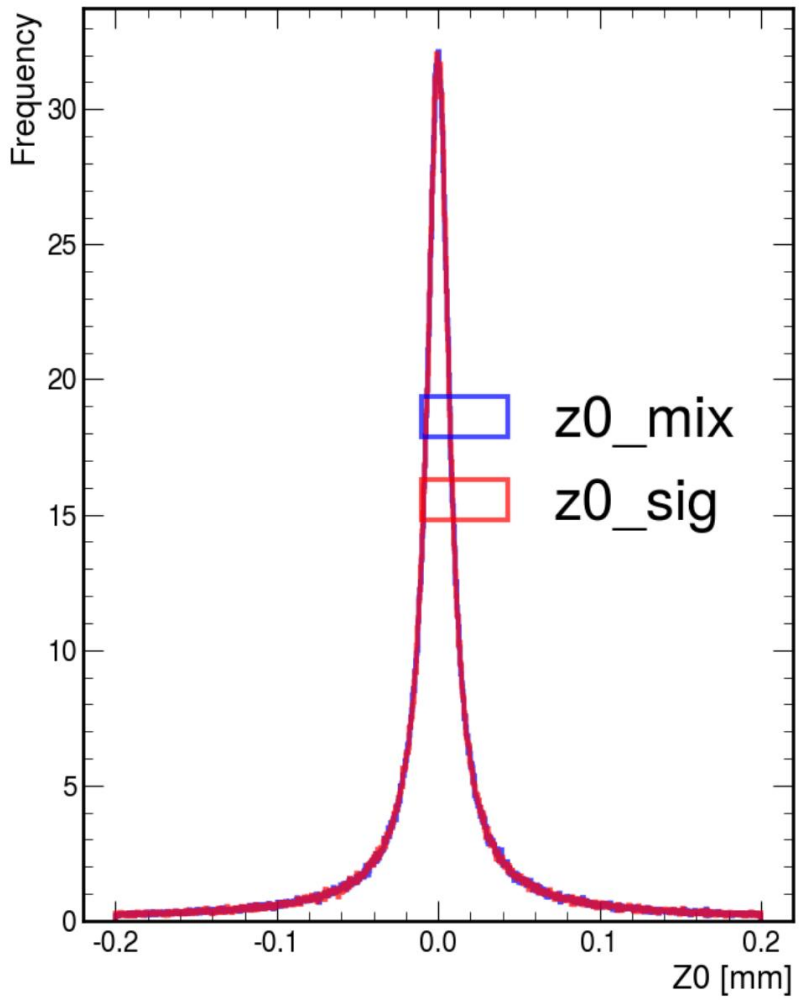
Most of bkg-contaminated tracks look like

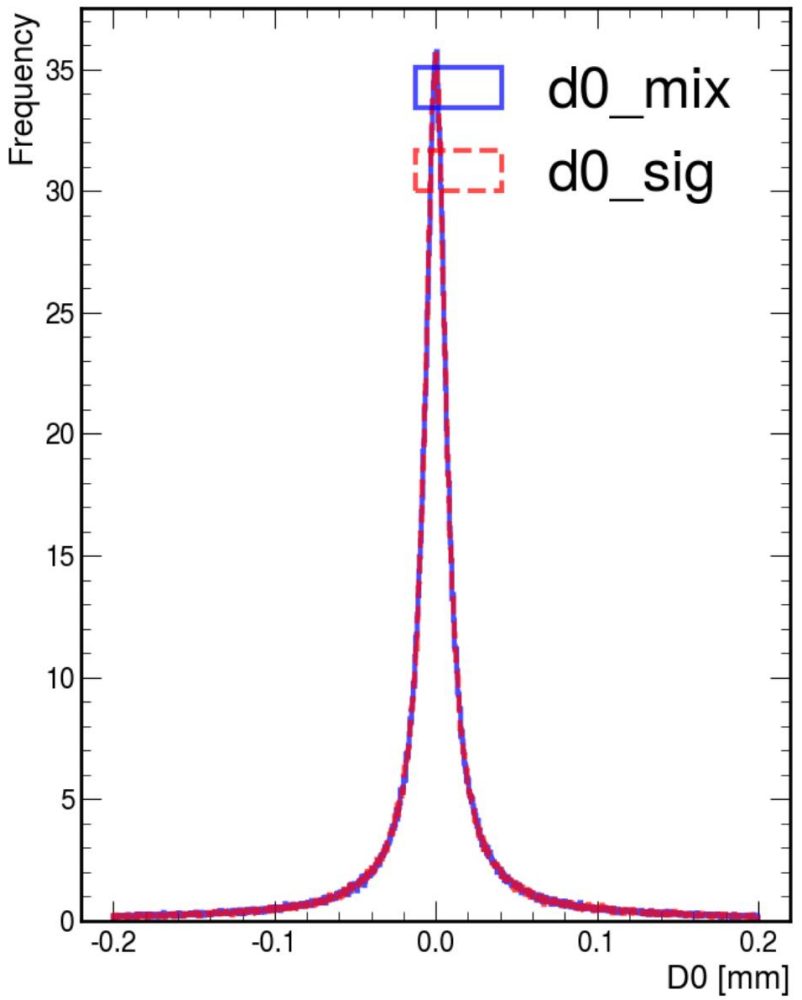


The single bkg hit is there because it is compatible with the signal hits
So, we do not expect the track to change a lot

Tracking

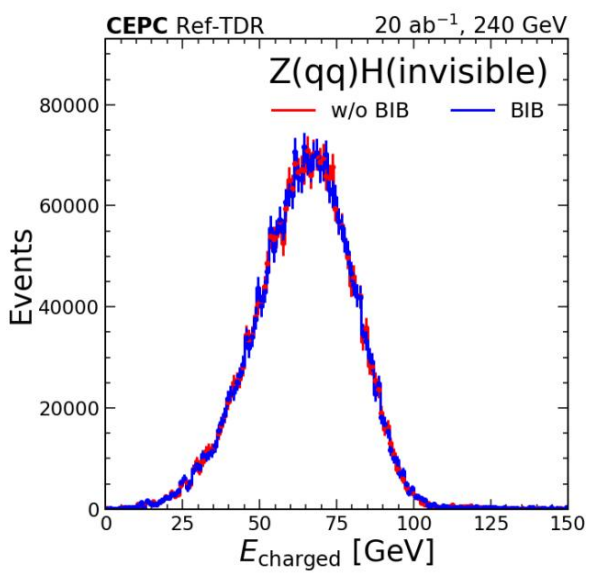

Frequency
175
150
125
100
75
50
25
0
deltapt_mix
deltapt_sig
-0.02
-0.01
0.00
0.01
0.02
deltapt [GeV]

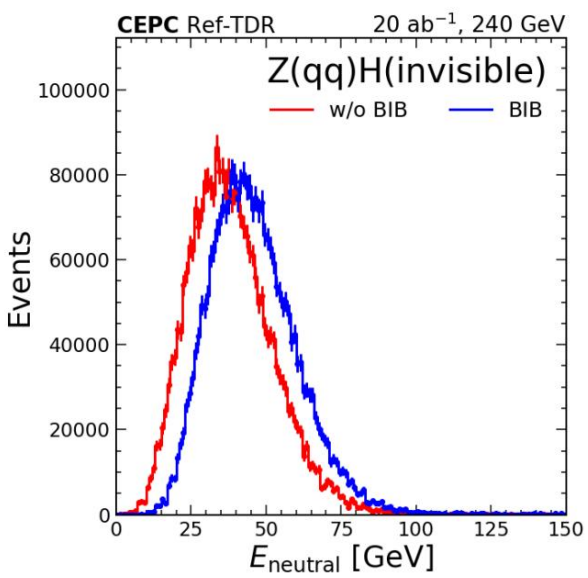

Frequency
30
25
20
15
10
5
0
z0_mix
z0_sig
-0.2
-0.1
0.0
0.1
0.2
Z0 [mm]

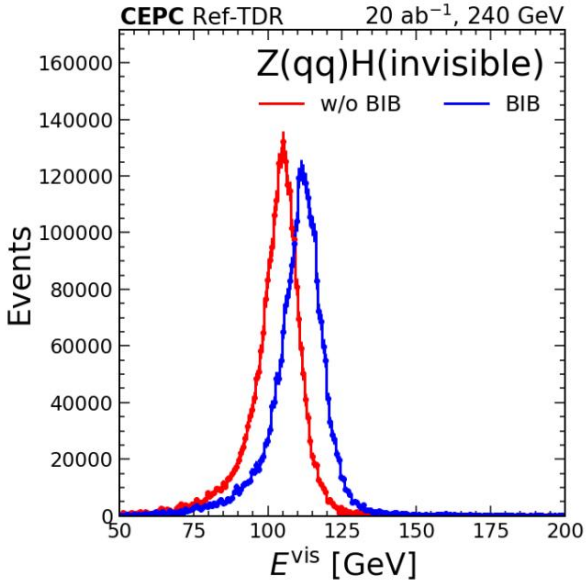

Frequency
35
30
25
20
15
10
5
0
d0_mix
d0_sig
-0.2
-0.1
0.0
0.1
0.2
D0 [mm]

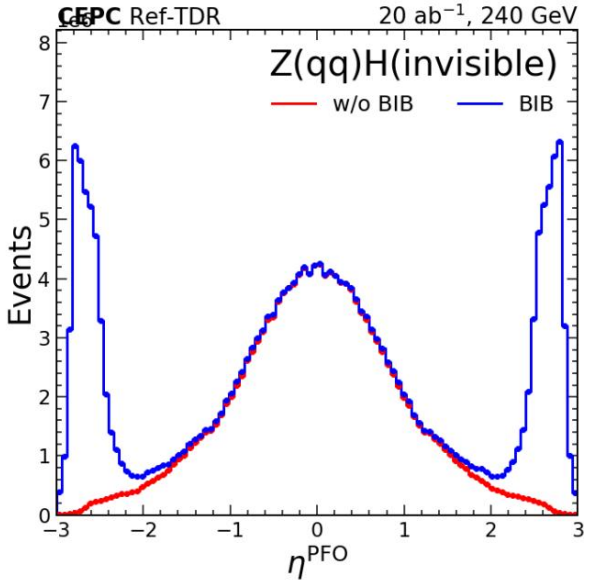
Calorimeter

Features





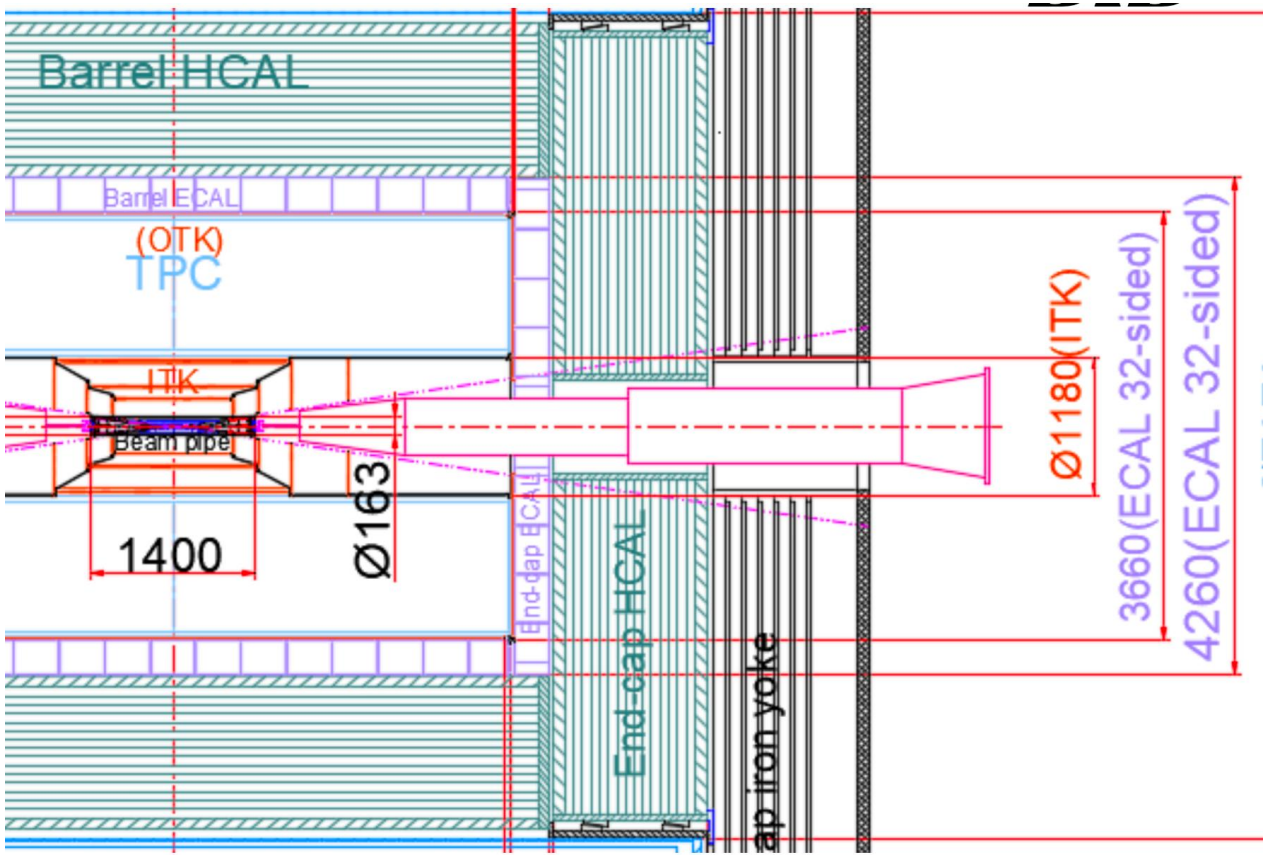


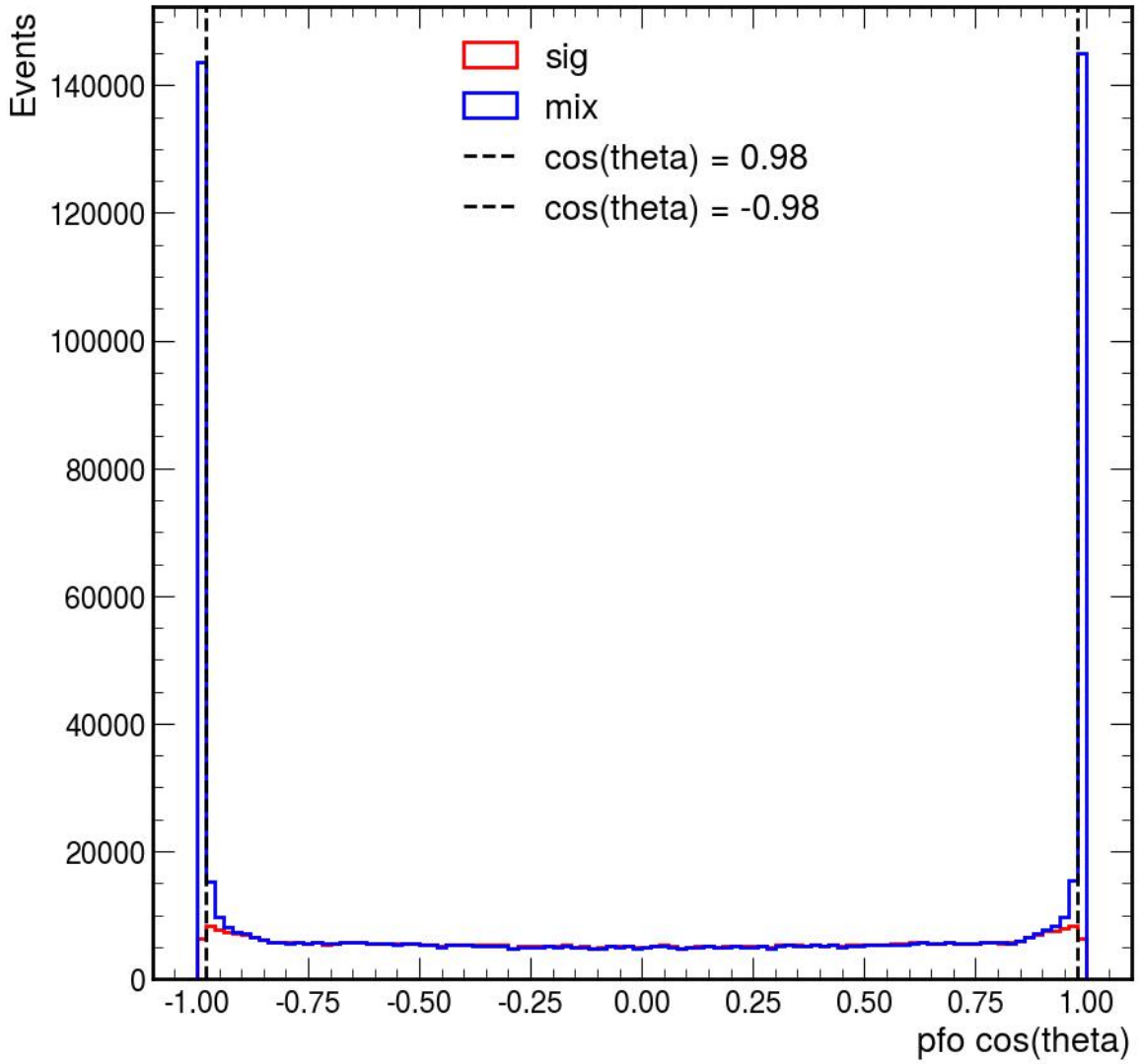


Key features

- Negligible effects on charged PFOs.
- More neutral PFOs induced, with an extra energy of ~ 7 GeV.
- Most extra PFOs lie in forward regions.

Calorimeter





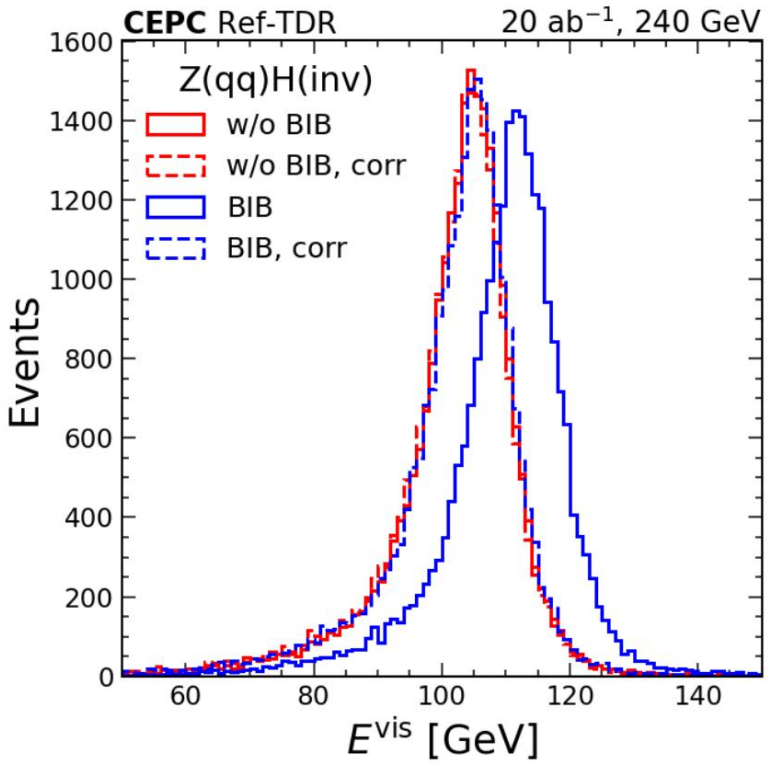
- HCAL time window: 1000 ns
- ECAL time window: 150 ns

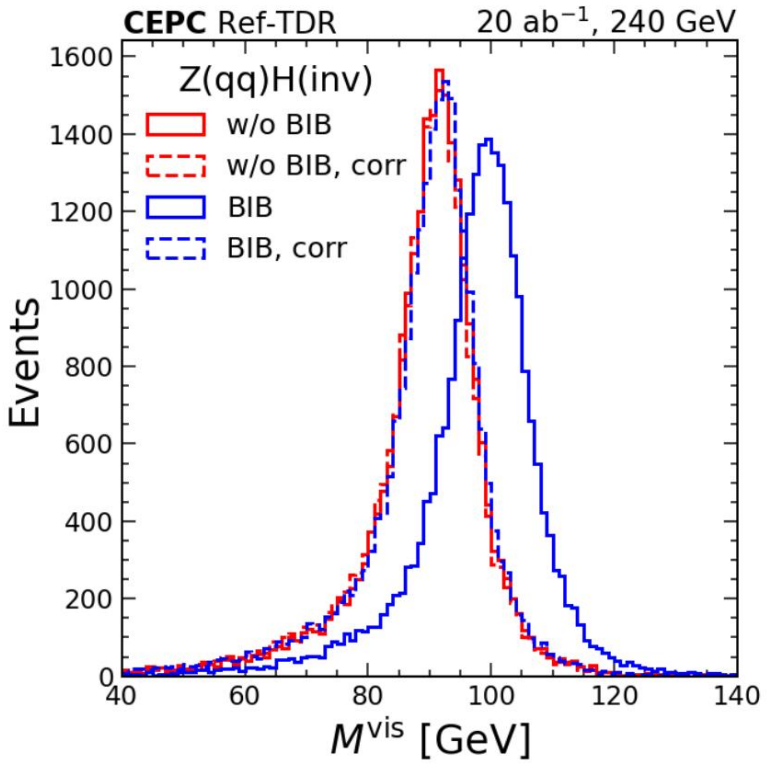
Calorimeter

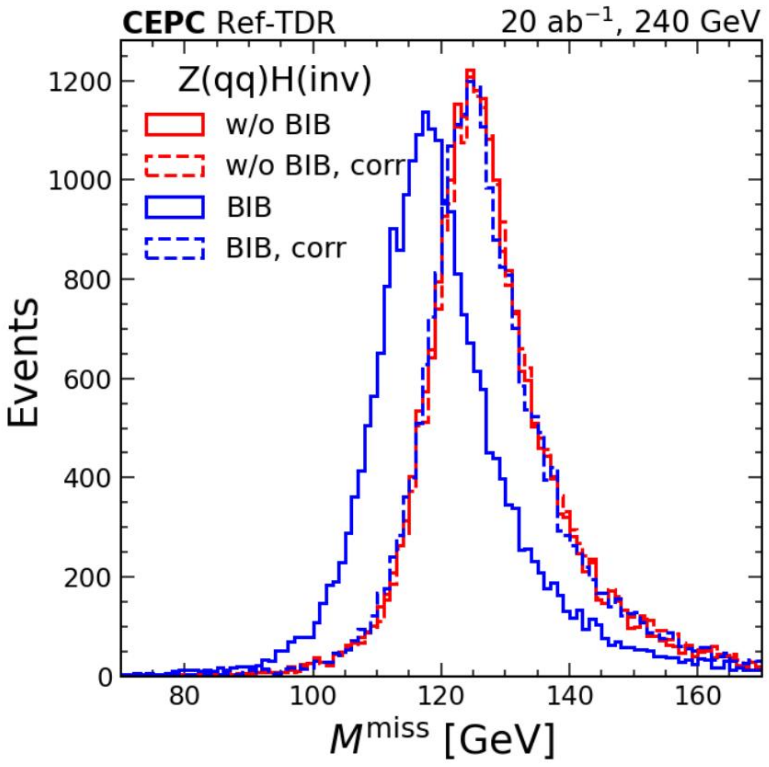
Preliminary BIB mitigation

Method

- Get rid of neutral PFOs with $|\cos\theta| > 0.98$
- From Weizheng

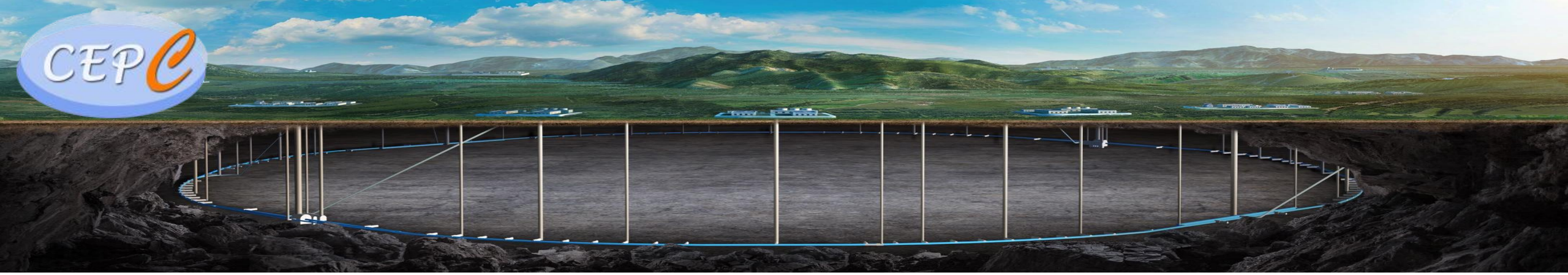






Summary

- The impacts of beam background on tracking and BMR have been studied through full simulation
  - The impacts on the track are negligible
  - It introduces many hits to the HCAL in the forward region, which can be mitigated by requiring PFOs $|\cos(\theta)| < 0.98$



Thank you for your attention!

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Backup