

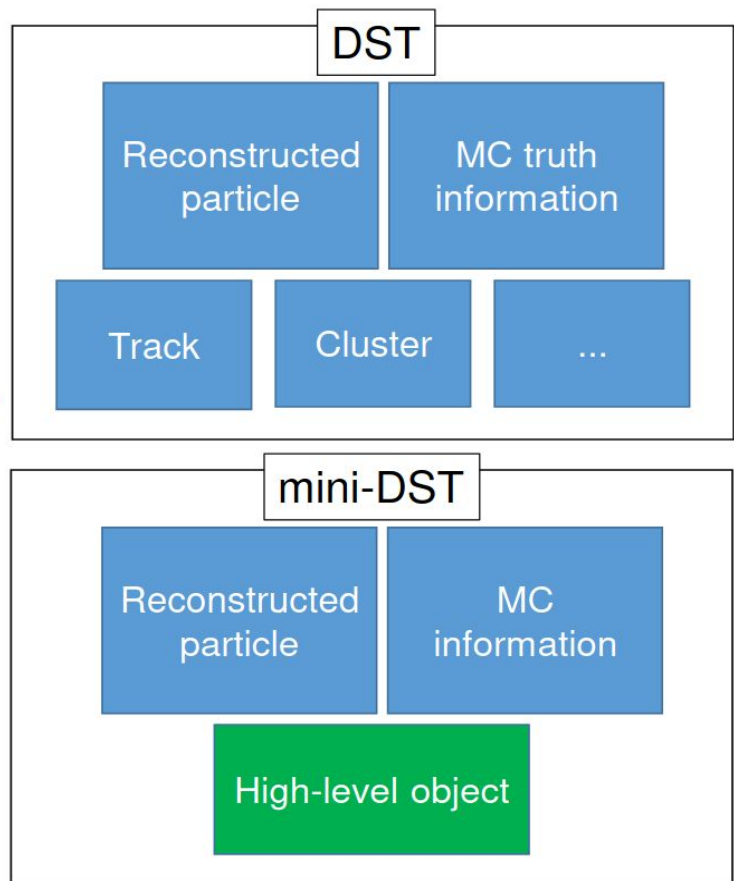
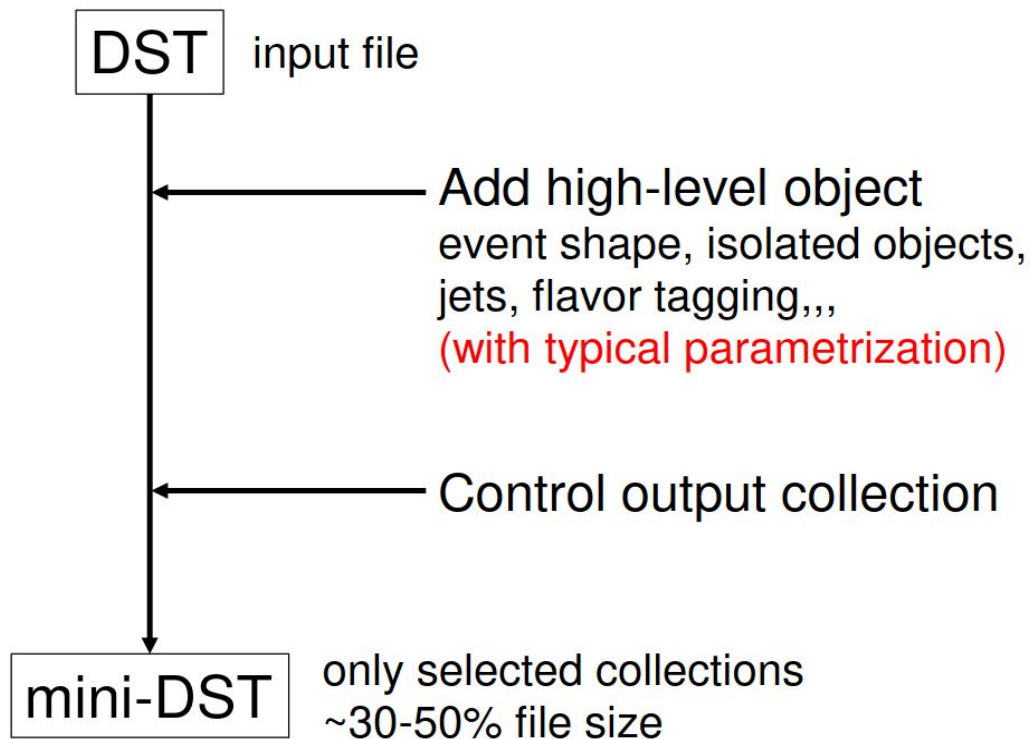


Updates

Héctor García Cabrera (CIEMAT)

Mini-DST

mini-DST in a nutshell



Details of mini-DST

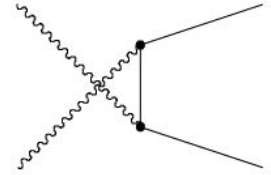
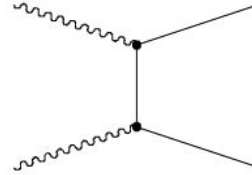
- Particle flow object (reconstructed particle)
 - including event shape variables, proton/kaon/pion ID, particles reconstructed with forward detectors
- MC truth information, links between reconstructed particle and MC truth
- High-level object
 - Isolated electrons/muons/taus/photons
 - Jets ($N = 2, 3, 4, \dots$ up to 10)
 - Durham algorithm applied to remained particle flow objects
 - Flavor tagging
 - Sophisticated MVA approach, giving three output classifications (b-, c-, other tag)

Overlays:

BB - Two real Beamstrahlung
gammas

BB

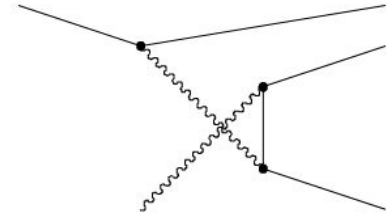
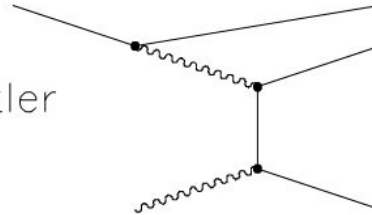
Breit–Wheeler
process



BW/WB - One real and one virtual
gamma

BW/WB

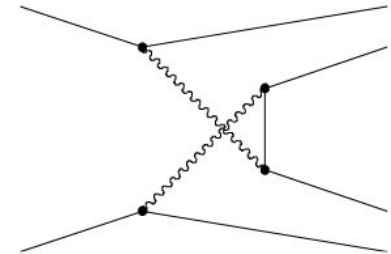
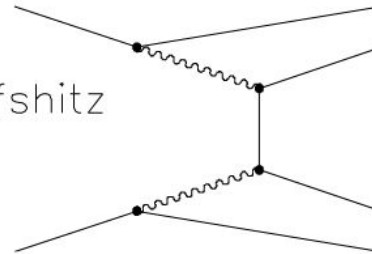
Bethe–Heitler
process



WW - Two virtual gammas

WW

Landau–Lifshitz
process



SeeablePairs - Pair production

WW

```

----- print out of MCParticle collection -----

flag: 0x0
simulator status bits: [sbvtcls]  s: created in simulation b: backscatter v: vertex is not endpoint of parent t: decayed in tracker c: decayed in calorimeter l: has left detector s: stopped o: overlay

[ id ] [index] [ PDG ] [ px, py, pz ] [ px_ep, py_ep, pz_ep ] [ energy ] [gen] [simstat ] [ vertex x, y, z ] [ endpoint x, y, z ] [ mass ] [ charge ]
[ spin | colorflow | [ parents ] - [ daughters ] ]

[00000005] 0| 11| 8.75e-01, 0.00e+00, 1.25e+02| 0.00e+00, 0.00e+00, 0.00e+00| 1.25e+02| 2 |[]| 0.00e+00, 0.00e+00, 1.21e-01| 0.00e+00, 0.00e+00, 1.21e-01| 0.00e+00|-1.00e+00| 0.00e+00,
0.00e+00, 0.00e+00| (0, 0) | [] - [2,3,4,5]
[00000006] 1| -11| 8.75e-01, 0.00e+00, -1.25e+02| 0.00e+00, 0.00e+00, 0.00e+00| 1.25e+02| 2 |[]| 0.00e+00, 0.00e+00, 1.21e-01| 0.00e+00, 0.00e+00, 1.21e-01| 0.00e+00| 1.00e+00| 0.00e+00,
0.00e+00, 0.00e+00| (0, 0) | [] - [2,3,4,5]
[00000007] 2| 11| -5.53e-01, -1.76e-02, 8.81e-01| 0.00e+00, 0.00e+00, 0.00e+00| 1.04e+00| 2 |[]| 0.00e+00, 0.00e+00, 1.21e-01| 0.00e+00, 0.00e+00, 1.21e-01| 0.00e+00|-1.00e+00| 0.00e+00,
0.00e+00, 0.00e+00| (0, 0) | [0,1] - [6,7]
[00000008] 3| -11| 2.73e-02, 7.22e-04, -6.16e-01| 0.00e+00, 0.00e+00, 0.00e+00| 6.16e-01| 2 |[]| 0.00e+00, 0.00e+00, 1.21e-01| 0.00e+00, 0.00e+00, 1.21e-01| 0.00e+00| 1.00e+00| 0.00e+00,
0.00e+00, 0.00e+00| (0, 0) | [0,1] - [6,7]
[00000009] 4| 11| 1.44e+00, 1.80e-02, 1.24e+02|-0.00e+00, 0.00e+00, 0.00e+00| 1.24e+02| 1 |[]| c s | 0.00e+00, 0.00e+00, 1.21e-01| 6.32e+01, 8.04e+00, 5.59e+03| 0.00e+00|-1.00e+00| 0.00e+00,
0.00e+00, 0.00e+00| (0, 0) | [0,1] - []
[00000010] 5| -11| 8.72e-01, -0.00e+00, -1.25e+02| 8.71e-01, -2.35e-02, -1.25e+02| 1.25e+02| 1 |[]| l | 0.00e+00, 0.00e+00, 1.21e-01| 1.05e+02, -2.60e+00, -1.50e+04| 0.00e+00| 1.00e+00| 0.00e+00,
0.00e+00, 0.00e+00| (0, 0) | [0,1] - []
[00000011] 6| 211|-8.24e-01, 2.75e-01, -3.09e-01| 0.00e+00, 0.00e+00, -0.00e+00| 9.33e-01| 1 |[]| c s | 0.00e+00, 0.00e+00, 1.21e-01|-2.72e+02, 1.38e+03, -2.45e+03| 1.40e-01| 1.00e+00| 0.00e+00,
0.00e+00, 0.00e+00| (0, 0) | [2,3] - [8,9]
[00000012] 7| -211| 2.99e-01, -2.92e-01, 5.74e-01|-0.00e+00, -0.00e+00, 0.00e+00| 7.24e-01| 1 |[]| c s | 0.00e+00, 0.00e+00, 1.21e-01|-6.86e+00, 4.93e+02, 2.69e+03| 1.40e-01|-1.00e+00| 0.00e+00,
0.00e+00, 0.00e+00| (0, 0) | [2,3] - []
[00000013] 8| 11| 1.07e-03, 6.95e-04, -1.07e-03| 0.00e+00, -0.00e+00, -0.00e+00| 1.74e-03| 0 |[]| s vt s | -5.31e+02, 9.65e+02, -2.27e+03|-5.31e+02, 9.67e+02, -2.28e+03| 5.11e-04|-1.00e+00| 0.00e+00,
0.00e+00, 0.00e+00| (0, 0) | [6] - []
[00000014] 9| 11| 2.64e-04, 1.58e-03, -1.96e-03| 0.00e+00, 0.00e+00, 0.00e+00| 2.58e-03| 0 |[]| s vt s | -4.79e+02, 1.11e+03, -2.33e+03|-4.84e+02, 1.11e+03, -2.34e+03| 5.11e-04|-1.00e+00| 0.00e+00,
0.00e+00, 0.00e+00| (0, 0) | [6] - []

```


Overlay CLIC and ILC

LCD-Note-2011-006



Huge beam-induced background at CLIC

- $\gamma\gamma \rightarrow \text{had.}$
important for detector performance

- Timing cuts on PFOs to reduce this bckg.

Virtual W $\rightarrow$ low **p**, **E** of decay products
 $\rightarrow$ big influence of $\gamma\gamma \rightarrow \text{had.}$ background!

Timing cuts not implemented in Delphes model for CLIC

We apply effective cuts on the generator level

Overlay CLIC and ILC

After timing cuts on **hits** in full sim.: 10 ns after physical event left



Additional timing cuts on PFOs to reduce $\gamma\gamma \rightarrow \text{had. backg.}$

Example: Accept **tracks** with $p_T \leq 1 \text{ GeV}$ with $t < 2 \text{ ns}$

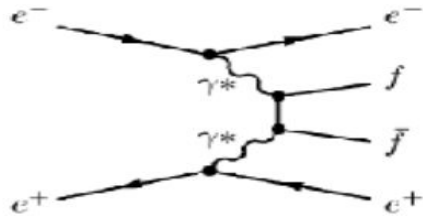


1. Take gen-level gamma-gamma events in batches of 20
2. Accept specific particles from first N events
 - based on cuts from CLIC CDR
3. Overlay on physical sample

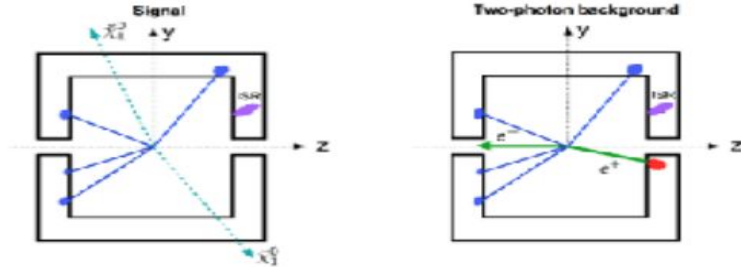
Overlay for SUSY

The Standard Model and the Signal

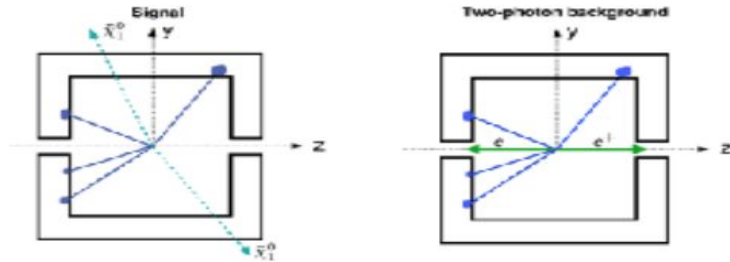
- The $\gamma\gamma \rightarrow 2f$ background has same signature as the signal



- A hard ISR photon is required to suppress this type background



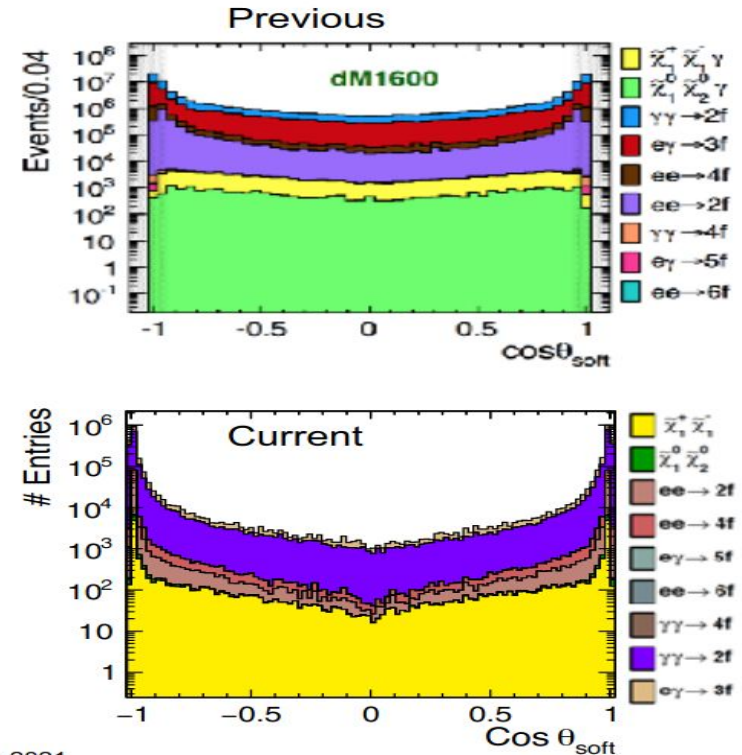
- In the final state: $e^+e^- \rightarrow \tilde{\chi}_1^+ \tilde{\chi}_1^- \gamma$
- A few soft visible particles
- A large missing energy ($2\tilde{\chi}_1^0$)



Overlay for SUSY

The impact of $\gamma\gamma$ overlay

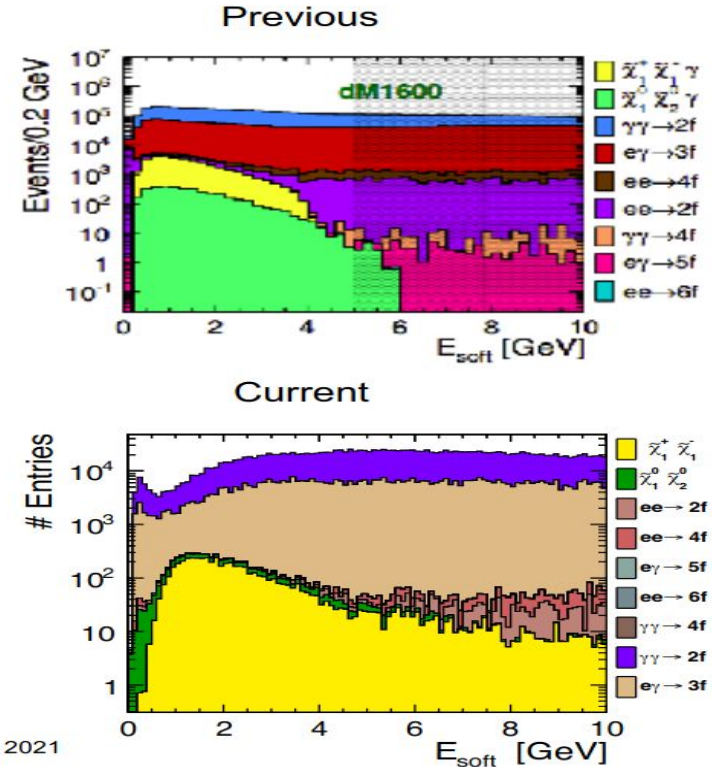
- The presence of $\gamma\gamma \rightarrow$ low p_T hadron overlay changes the topology of events
- All particles should have $|\cos\theta| < 0.9397 \Rightarrow 20^\circ$ away from the beam
- $\gamma\gamma \rightarrow$ low p_T hadron particles found in forward part of the detector



Overlay for SUSY

The impact of $\gamma\gamma$ overlay

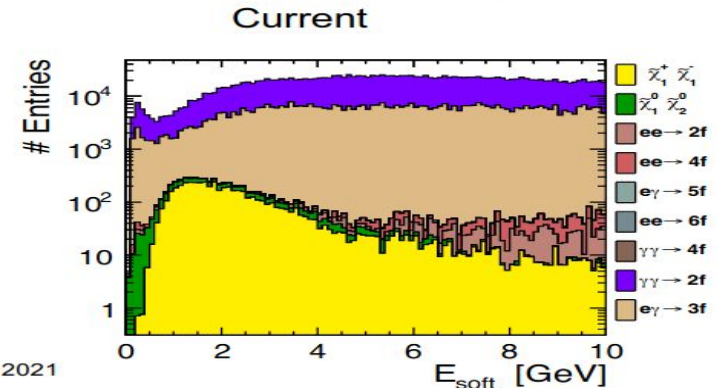
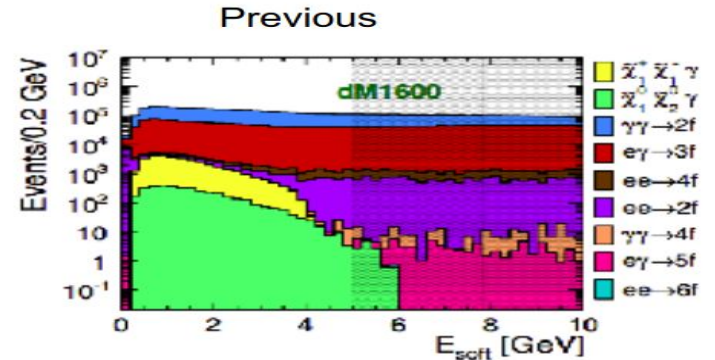
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- $\gamma\gamma \rightarrow$ low p_T hadron particles found in forward part of the detector
- Every particle should have $E < 5$ GeV



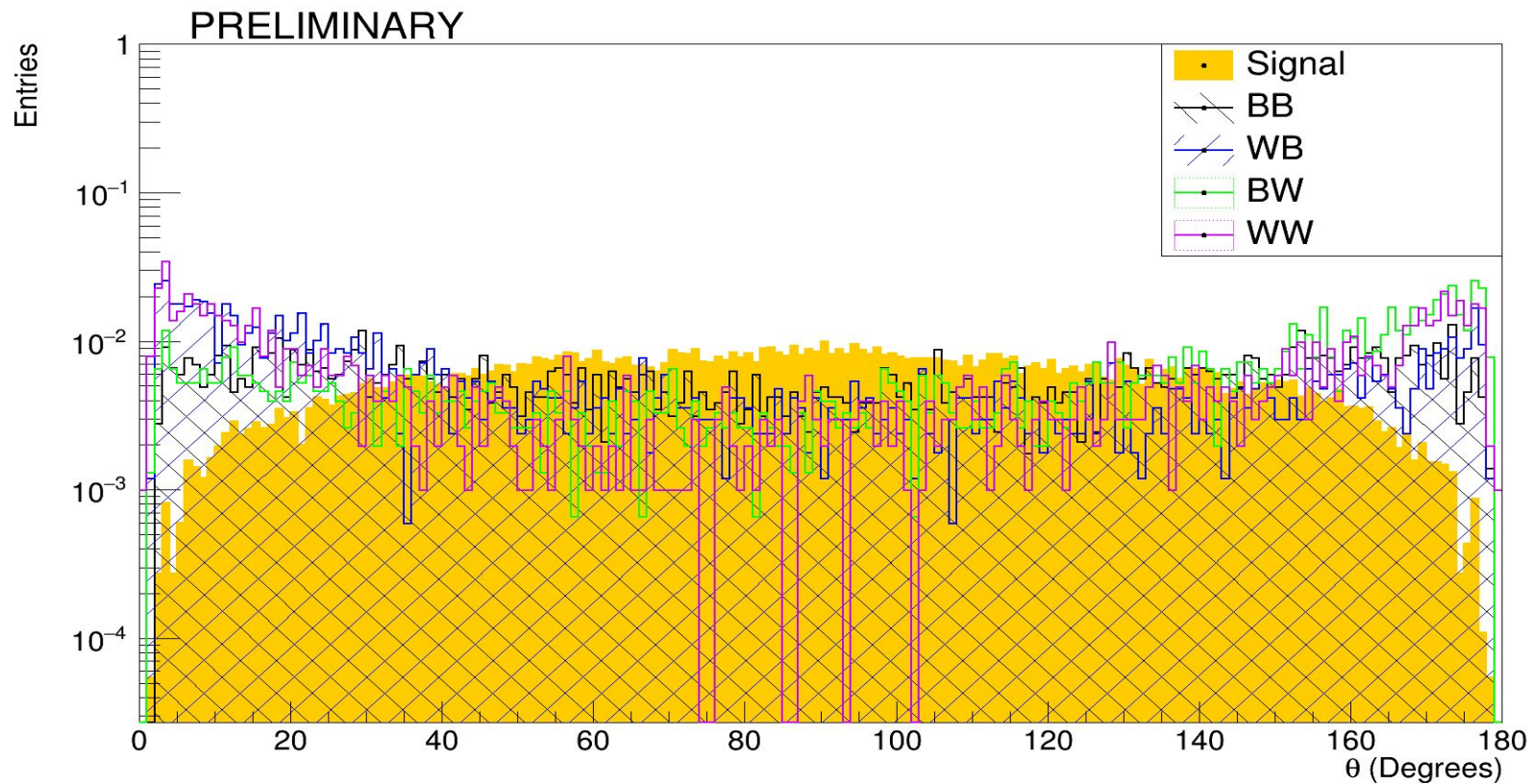
Overlay for SUSY

The impact of $\gamma\gamma$ overlay

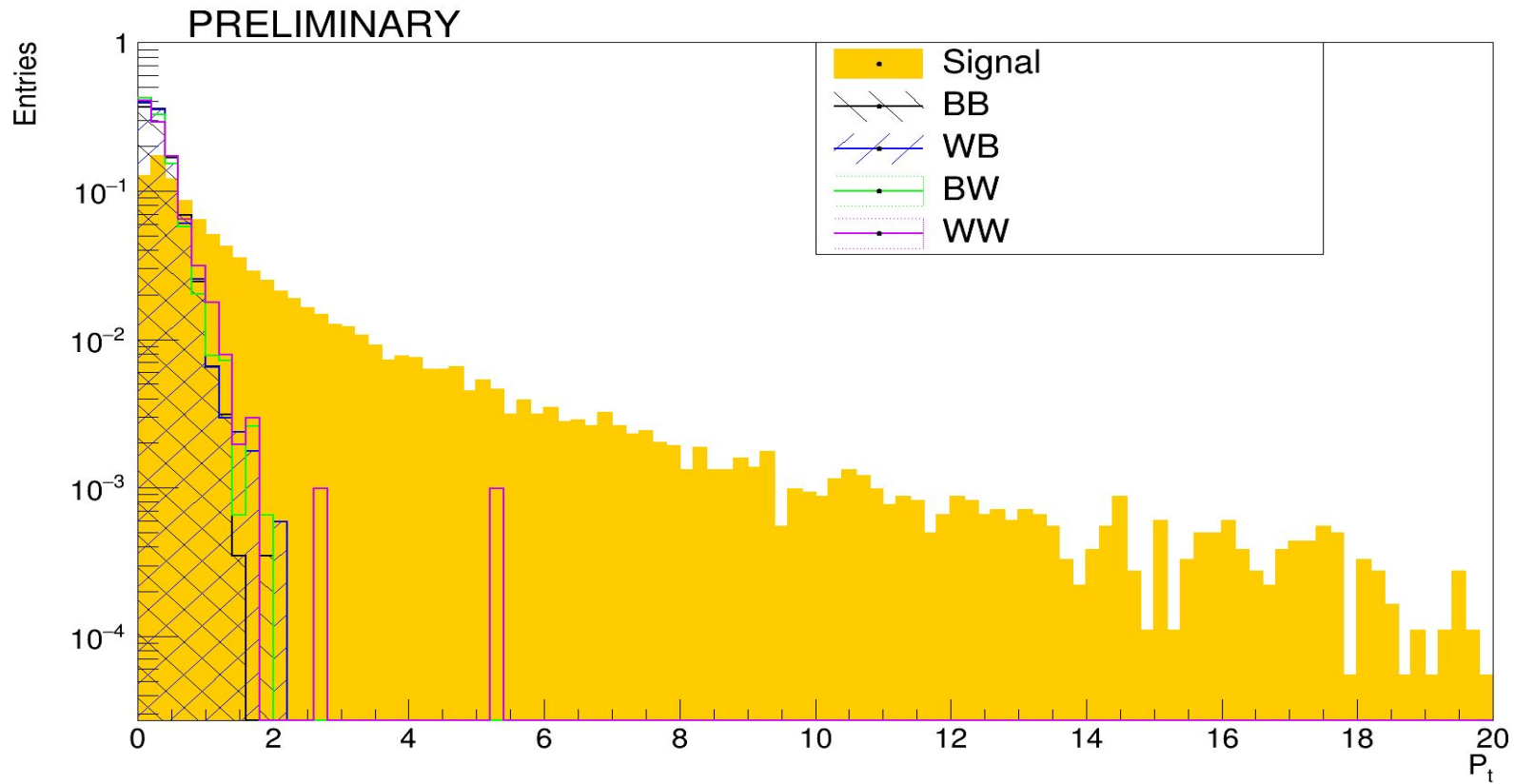
- The presence of $\gamma\gamma \rightarrow$ low p_T hadron overlay changes the topology of events
- All particles should have $|\cos\theta| < 0.9397 \Rightarrow 20^\circ$ away from the beam
- $\gamma\gamma \rightarrow$ low p_T hadron particles found in forward part of the detector
- Every particle should have $E < 5$ GeV
- Previous analysis only had particles from the higgsino decays
- To reduce impact of $\gamma\gamma \rightarrow$ low p_T overlay $\Rightarrow$ separation of signal and overlay required



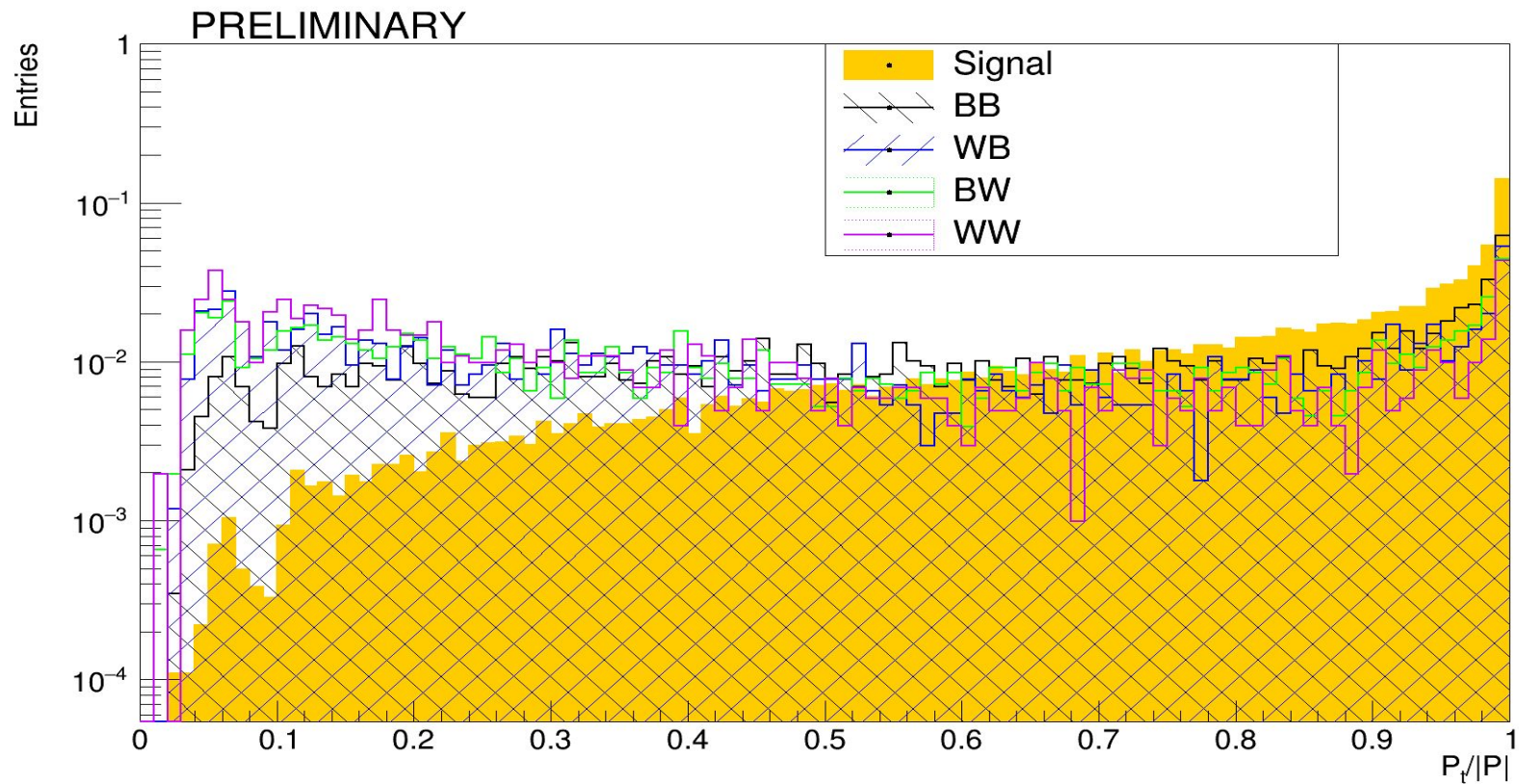
PFO - Angle



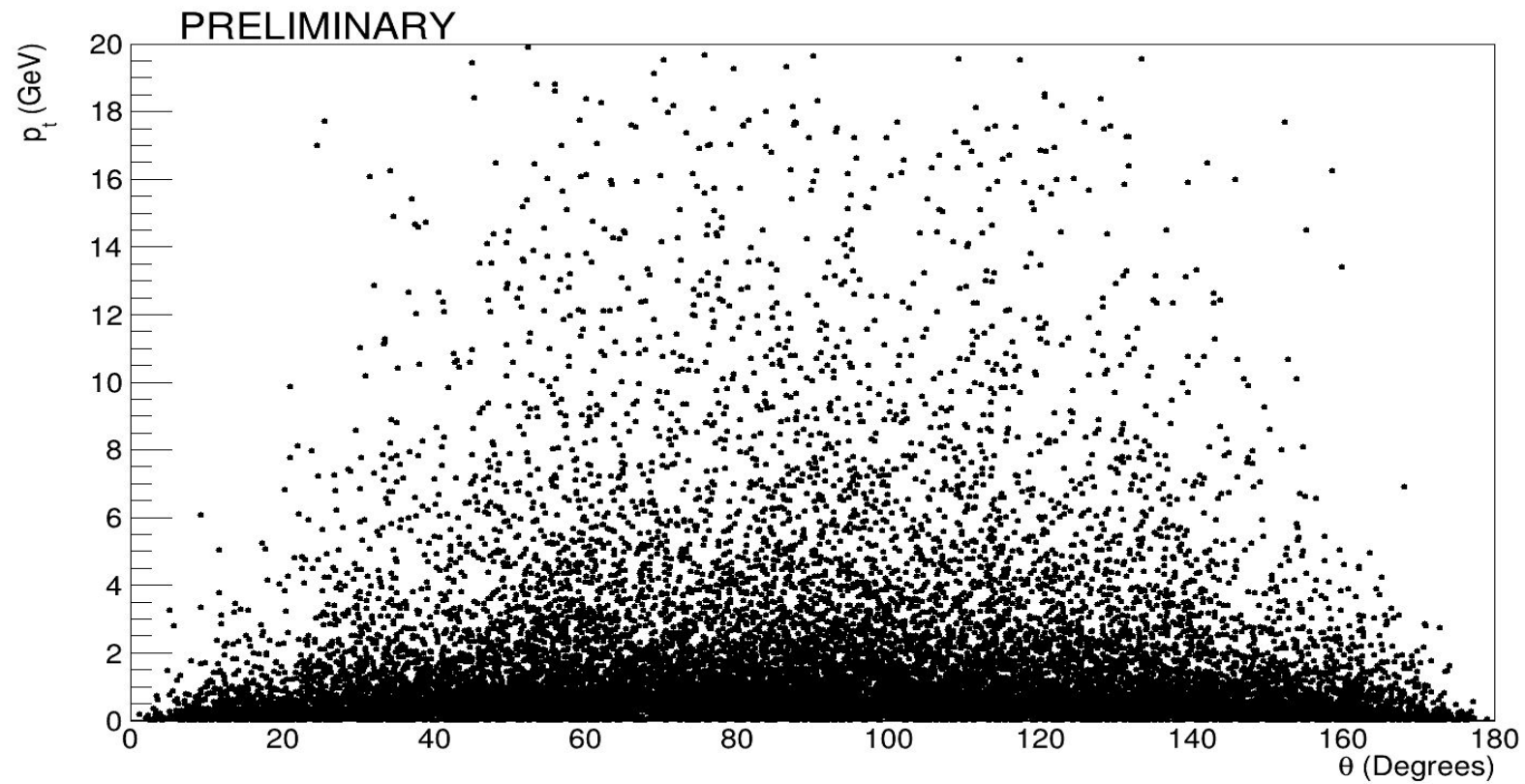
$PFO - P_t$

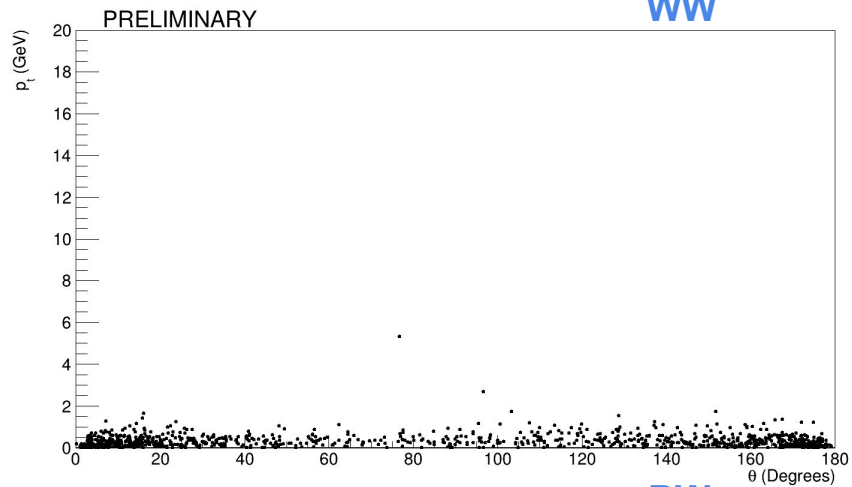
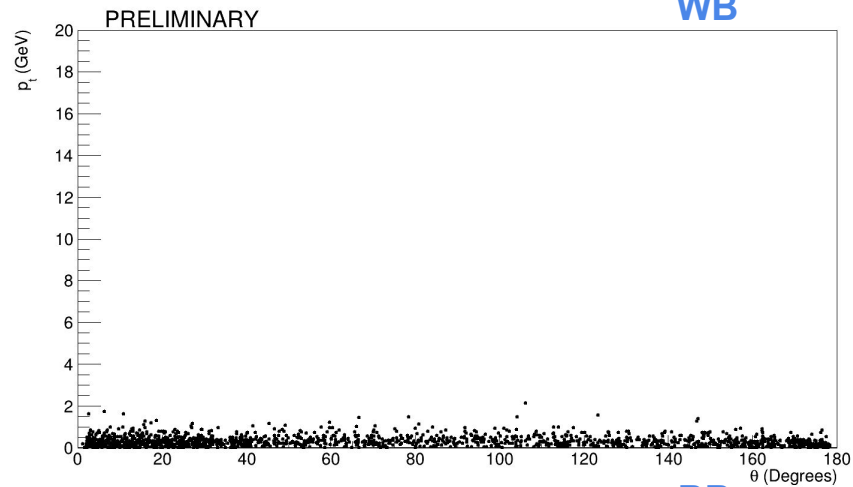
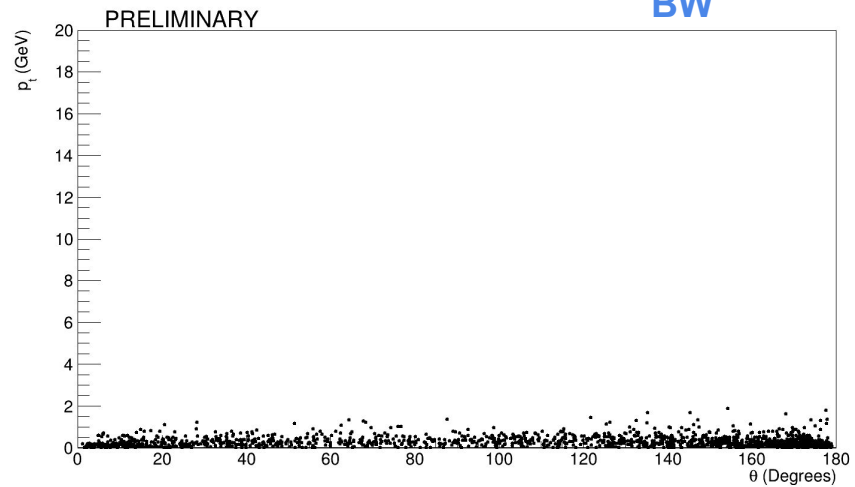


$PFO - Pt/|P|$



Theta vs Pt



WW**WB****BW****BB**