

EEEMCal performance under background conditions

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Question

Background contributions have an appreciably high rate at very negative rapidity. One could imagine that the signal clusters overlap with background.

What is the effect of that on the energy resolution?

Setup

The merging is done using

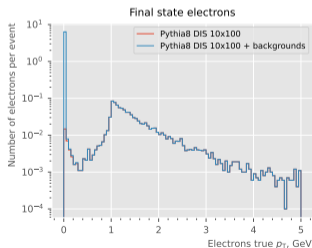
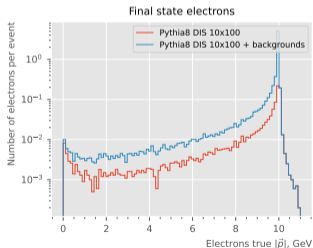
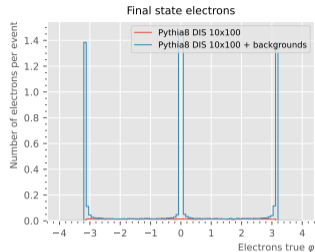
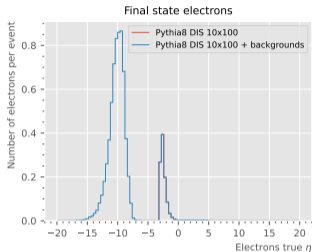
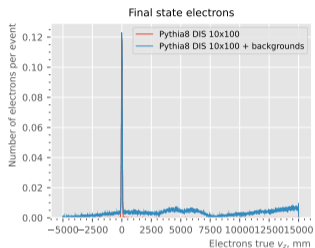
```
python HEPMC_Merger/signal_background_merger.py
--squashTime
-i "pythia8NCDIS_10x100_minQ2=1_beamEffects_xAngle=-
0.025_hiDiv_1.hepmc" -bg1 "100GeV.hepmc"
-bg2 "../beam_gas_ep_10GeV_foam_emin10keV_10Mevt_vtx.hepmc" -bg3 ""
-sf 0 -bf1 31347.96238244514 -bf2 314.7375875363915
```

- ▶ Signal input file
- ▶ Proton and electron beam gas input files
- ▶ Background rates in ns ($10^9/31900.$ and $1^9/3177250.$ ns respectively)

Passing `--squashTime` prevents EICrecon from removing signal calorimeter hits when the timing cut is applied.

Truth electron distributions

This is based on MCParticles

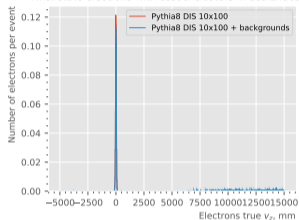


Funky φ distribution is explained by the lattice?

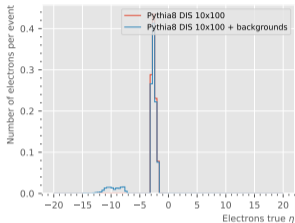
Truth electron distributions: those with clusters

This is based on MCParticles with associated clusters in EcalEndcapN

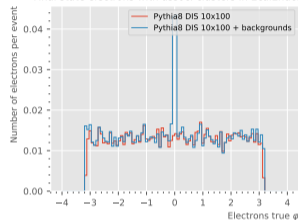
Final state electrons with assoc. clusters in EcalEndcapN



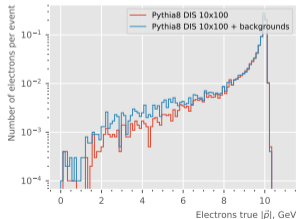
Final state electrons with assoc. clusters in EcalEndcapN



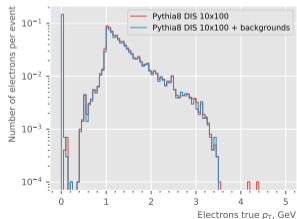
Final state electrons with assoc. clusters in EcalEndcapN



Final state electrons with assoc. clusters in EcalEndcapN

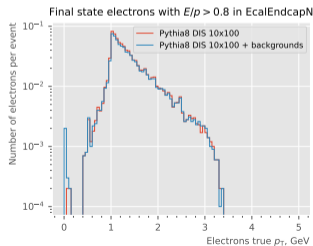
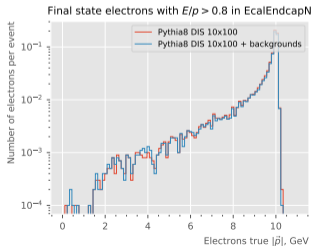
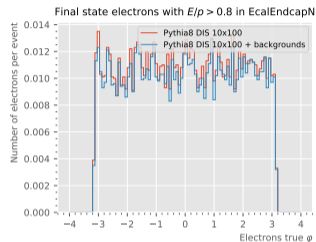
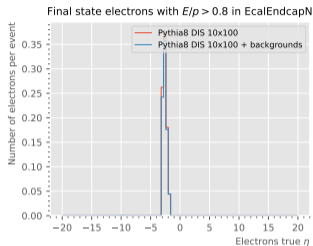
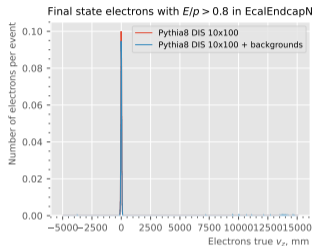


Final state electrons with assoc. clusters in EcalEndcapN



Truth electron distributions: those with clusters

This is based on MCParticles with associated clusters in EcalEndcapN, $E/p > 0.8$



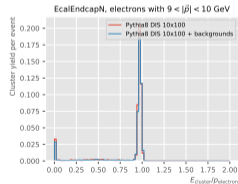
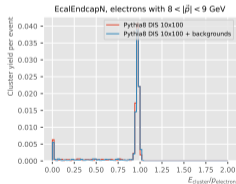
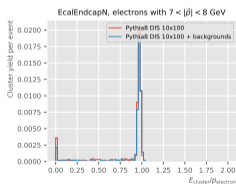
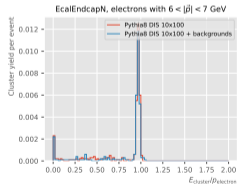
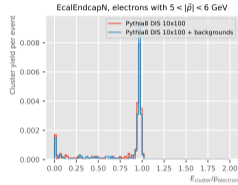
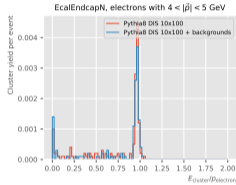
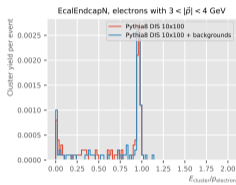
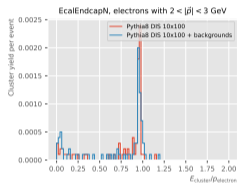
Actual study

Approach is to find all cluster associations that match to truth primary electrons with origin at $|v_z| < 10$ cm.

Then the $E_{\text{cluster}}/p_{\text{thrown}}$ is plotted in several ranges of p_{thrown} .

E/p distributions

This uses truth associations to match EcalEndcapN clusters to the electrons among MCParticles



Conclusions

- ▶ Effect on the resolution is small at high energy
- ▶ Would need more statistic to quantify (embed into single electron sample?)
- ▶ Truth-cluster associations degrade when backgrounds are needed
⇒ algorithm in the EICrecon needs to be improved