Centrality dependence study of reconstructed π^0 with MPD

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MPD collaboration

Outline

1、Dataset

2、Centrality dependence of $\boldsymbol{\pi^0}$ in ECal

3、Centrality dependence of $\boldsymbol{\pi^0}$ in hybrid method

4、Summary

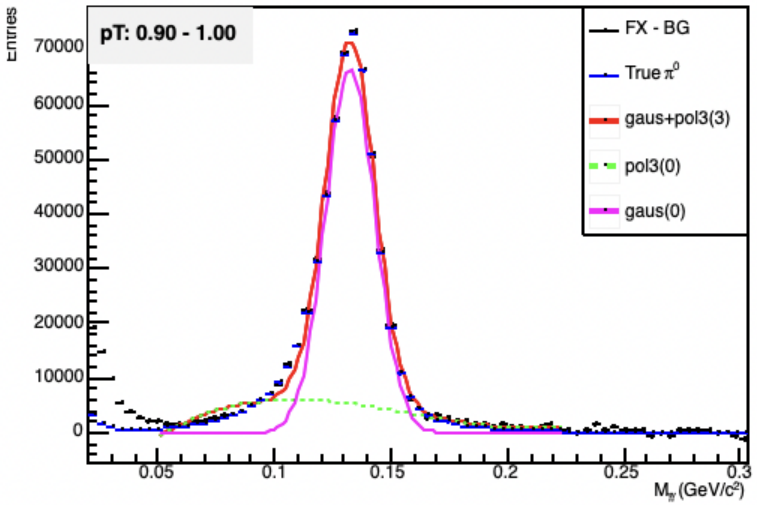
Dataset

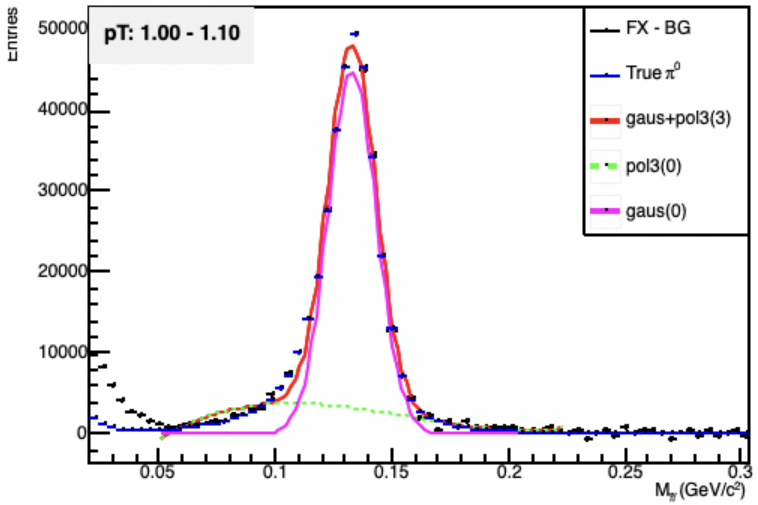
- Collision system: Bi+Bi @9.2GeV
- Event generator: UrQMD
- Production: 50M events https://mpdforum.jinr.ru/t/request-8-input-request-25/622 + 50M events https://mpdforum.jinr.ru/t/request-9-input-request-34/631
- Analysis Train (wagon - pairGG): https://mpdforum.jinr.ru/t/request-25-general-purpose-50m-urqmd-bibi-9-2-second-collaboration-paper/455 + https://mpdforum.jinr.ru/t/request-34-general-purpose-15m-urqmd-bibi-9-2-dielectron-enhanced/618

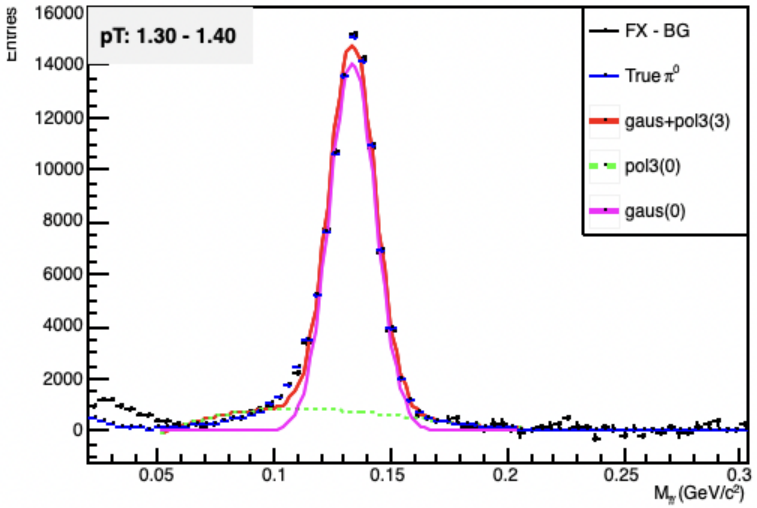
Event cut:

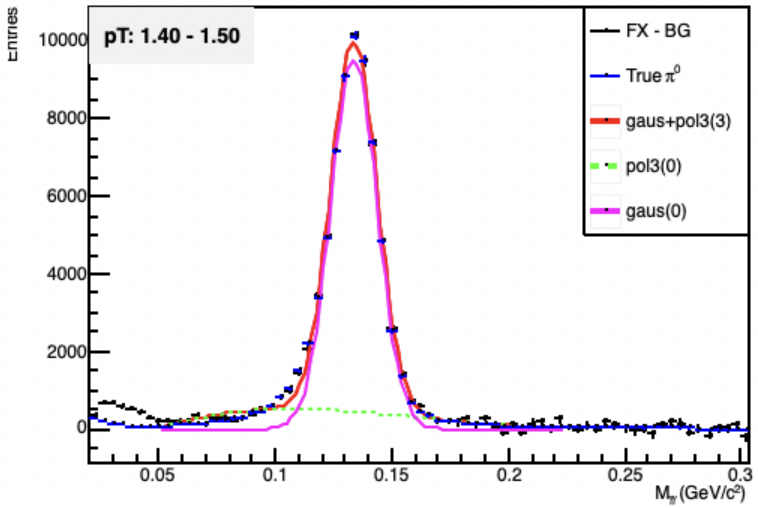
Primary vertex of event reconstructed and vertex_z cut < |100| cm

Reconstruction of π^0 via invariant mass in ECal









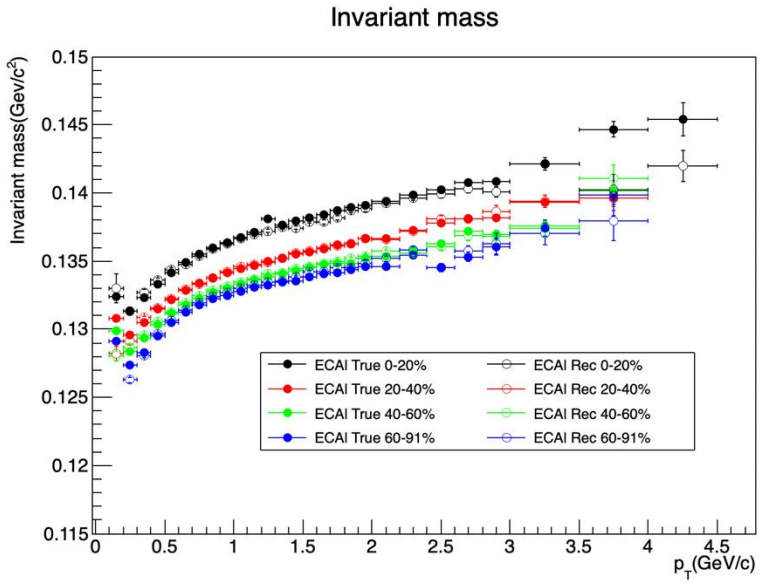
Photon cluster selection in ECal:

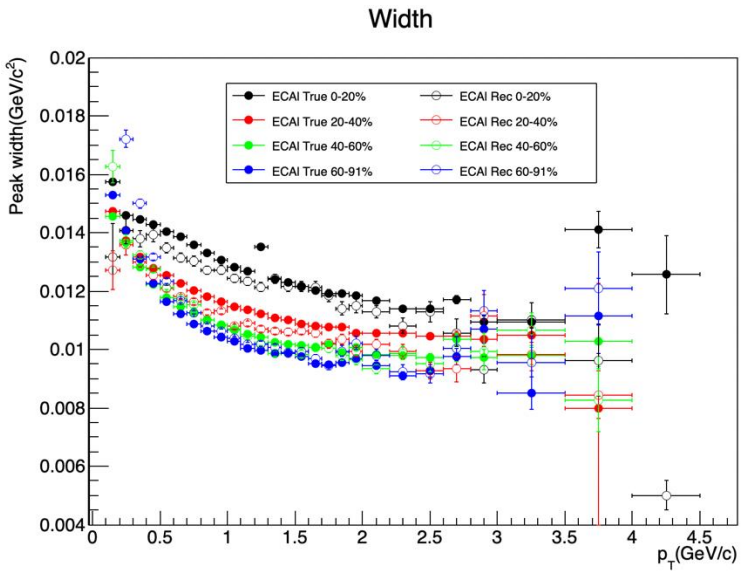
1、N_hit_tower>=2
2、reconstructed energy>=75MeV
3、Chi2<=4
4、tof<2ns

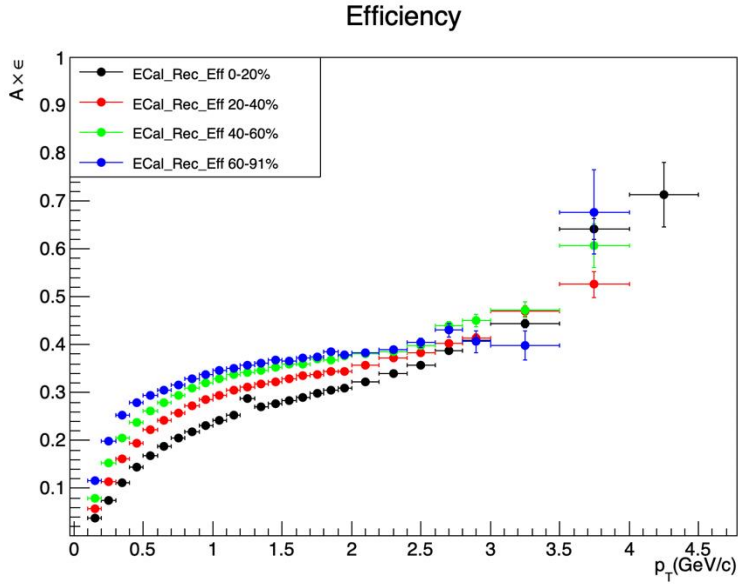
Centrality: 60-91%

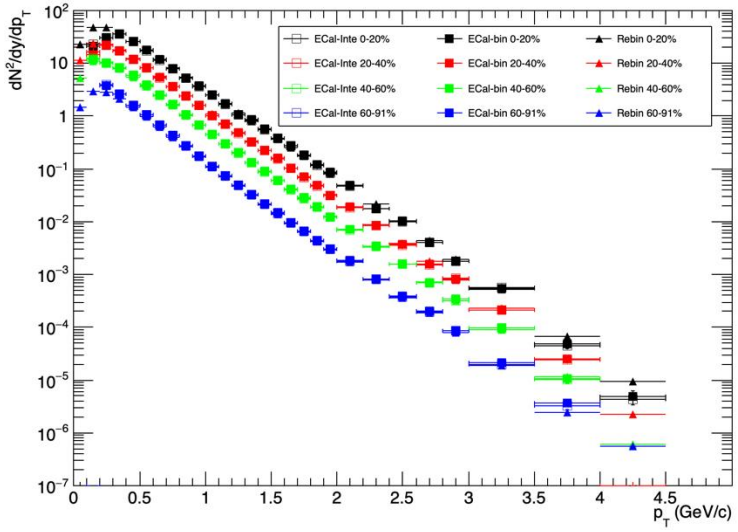
A clear excess is visible in distributions close to the nominal meson mass of 135 MeV/c^2 for the π^0.

Centrality dependence of π^0 in ECal (Chi2 cut)









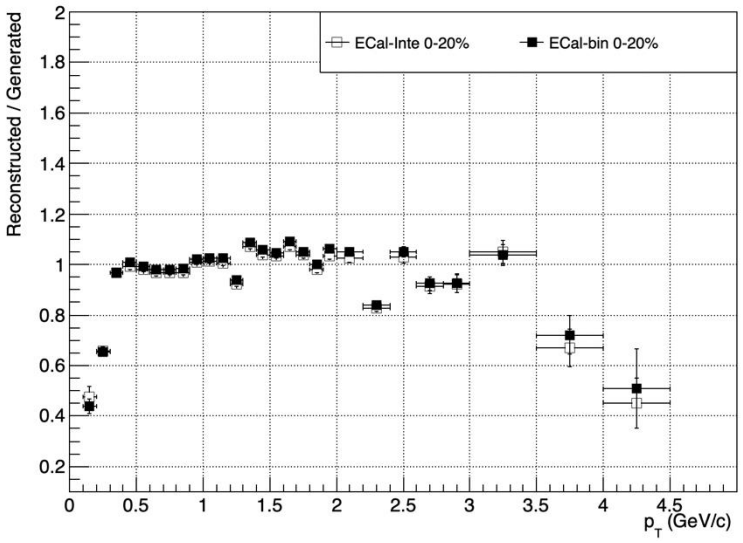
Photon cluster selection in ECal：

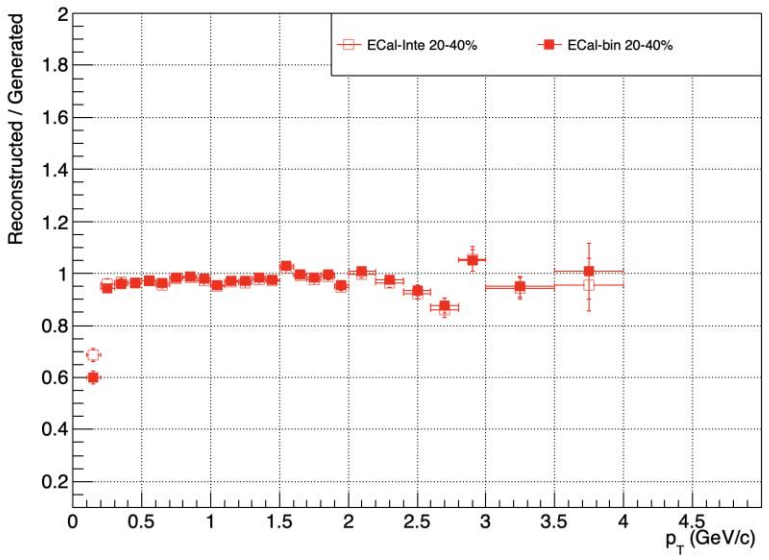
1、N_hit_tower>=2
2、reconstructed energy>=75MeV
3、Chi2<=4

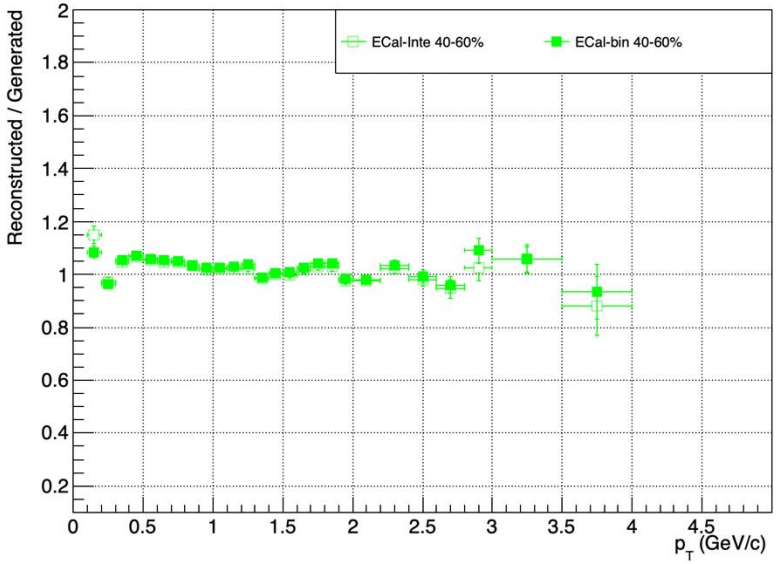
The invariant mass, peak width and yield of π^0 reconstructed and MC generated via two photons from ECal decrease as centrality increases within the same p_T range.

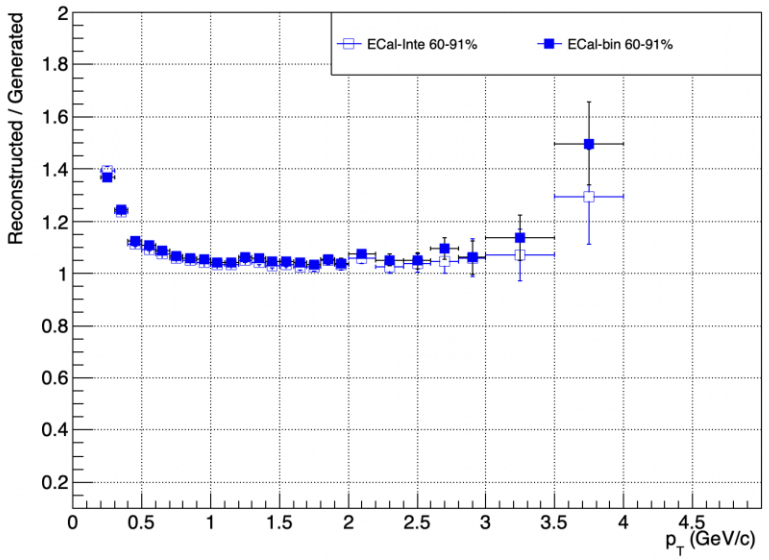
The reconstructed efficiency of π^0 in same p_T range increases with increasing centrality.

Centrality dependence of π^0 in ECal (Chi2 cut)







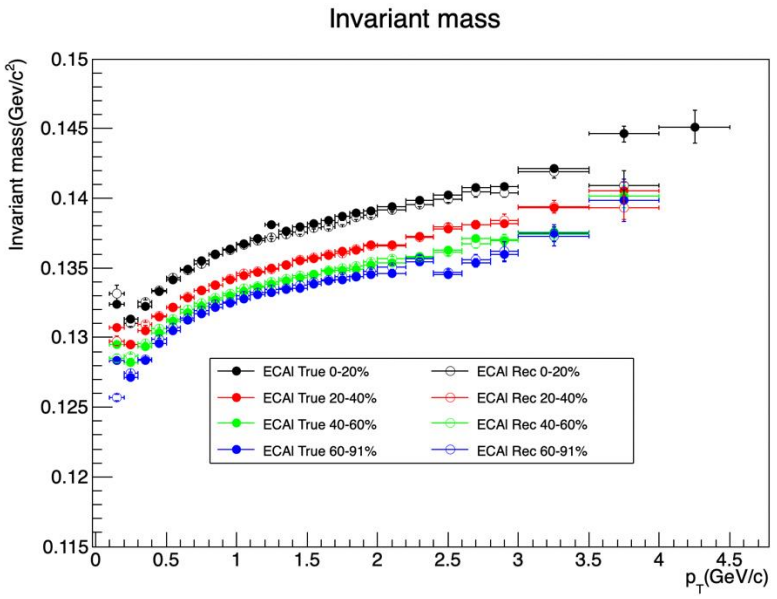


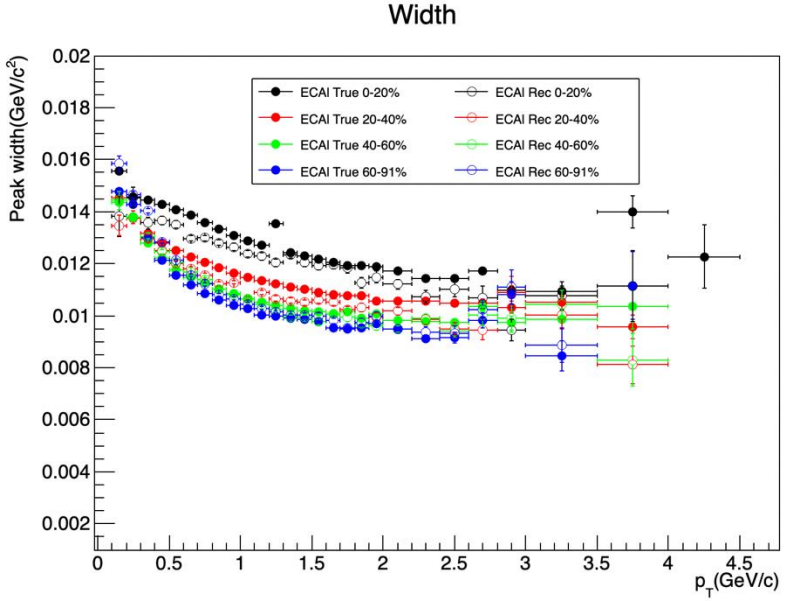
Photon cluster selection in ECal：

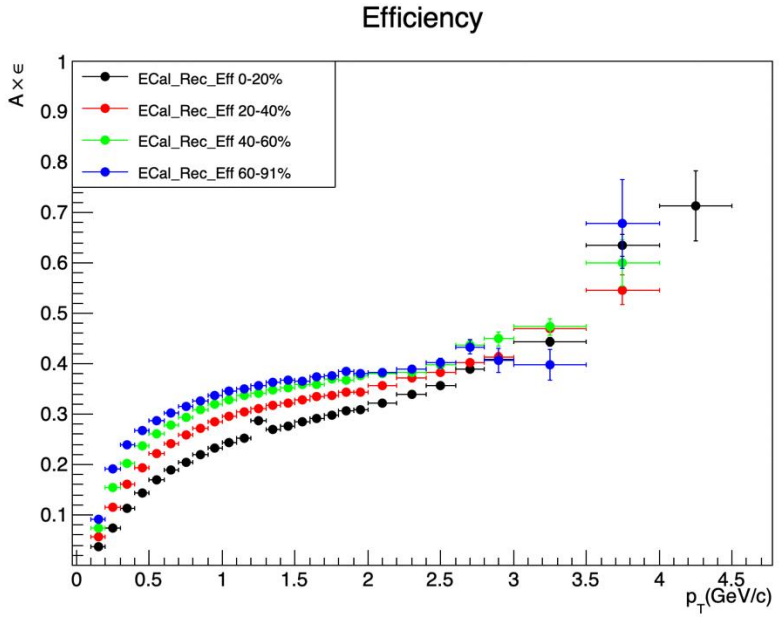
1、N_hit_tower>=2
2、reconstructed energy>=75MeV
3、Chi2<=4

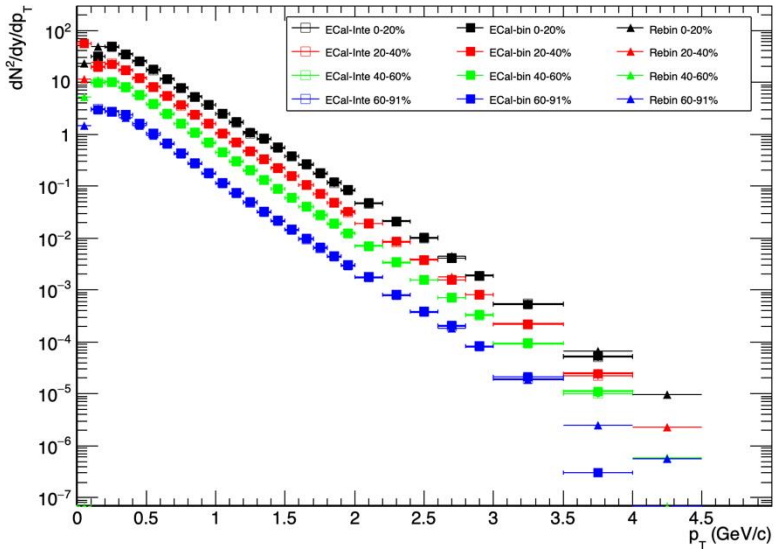
The results for reconstructed π^0 are consistent with the generated spectra in every centrality.

Centrality dependence of π^0 in ECal (Chi2 + Time cut)









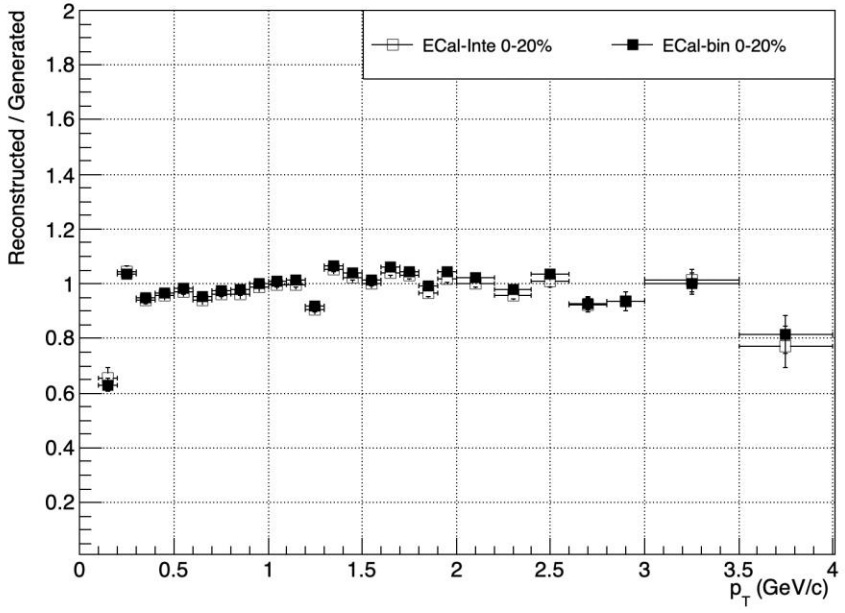
Photon cluster selection in ECal：

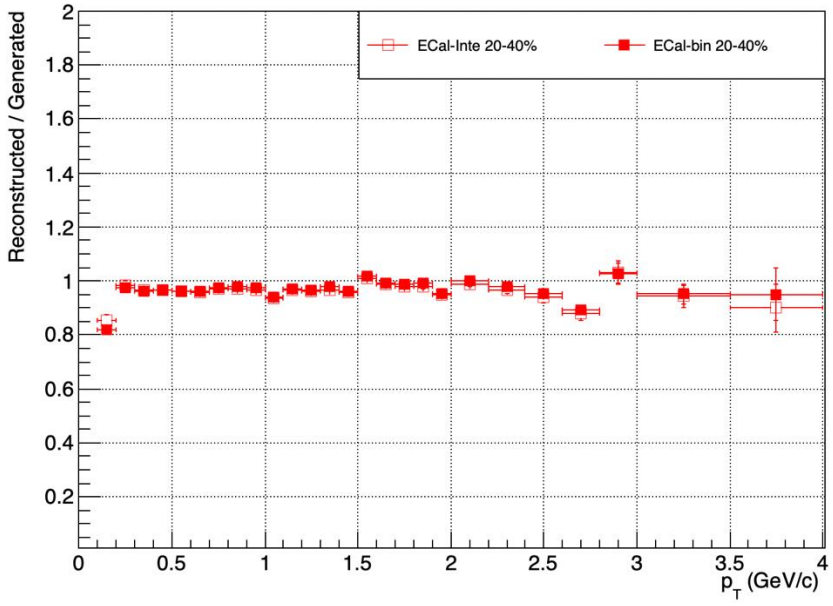
1、N_hit_tower>=2
2、reconstructed energy>=75MeV
3、Chi2<=4
4、tof<2ns

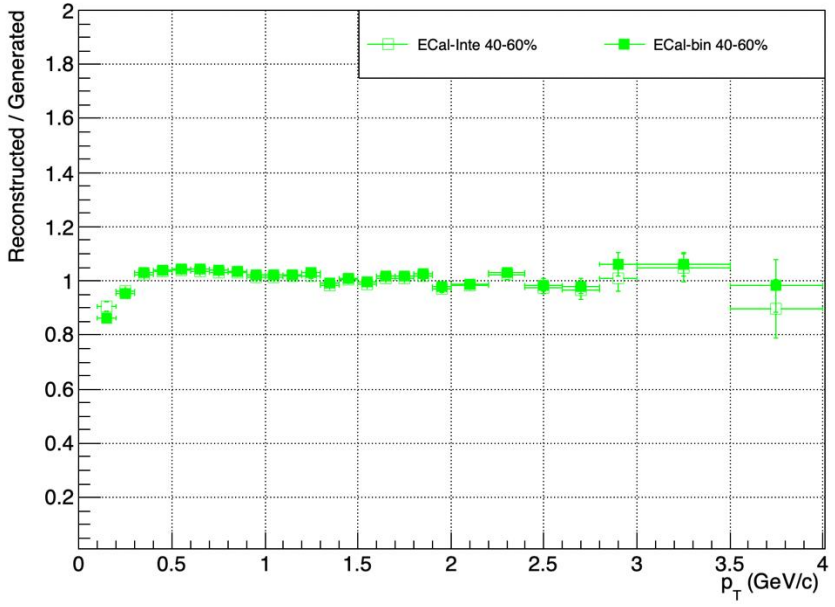
The invariant mass, peak width and yield of π^0 reconstructed and MC generated via two photons from ECal decrease as centrality increases within the same p_T range.

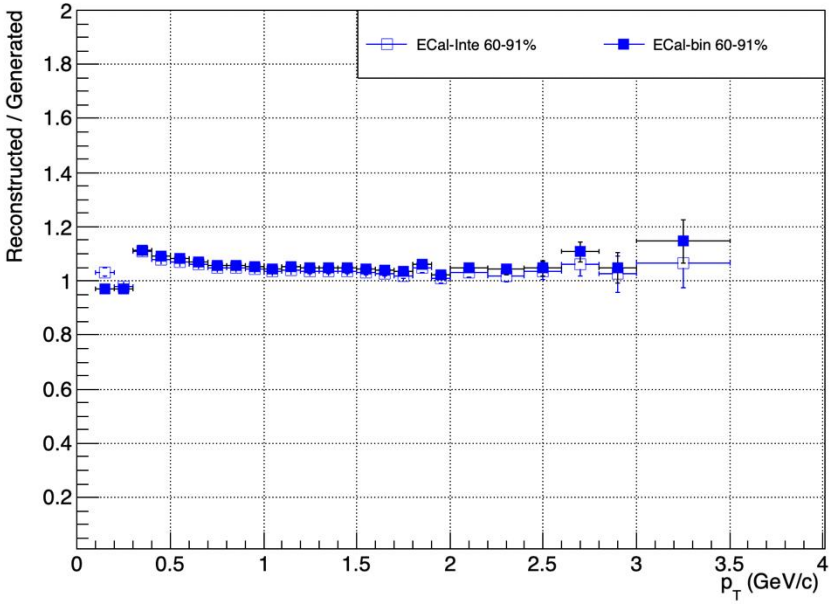
The reconstructed efficiency of π^0 in same p_T range increases with increasing centrality.

Centrality dependence of π^0 in ECal (Chi2 + Time cut)



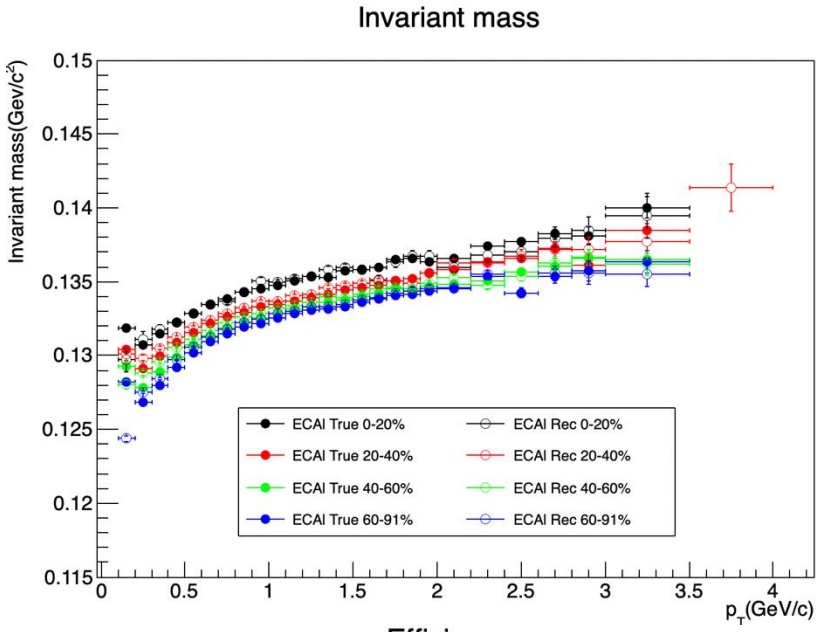


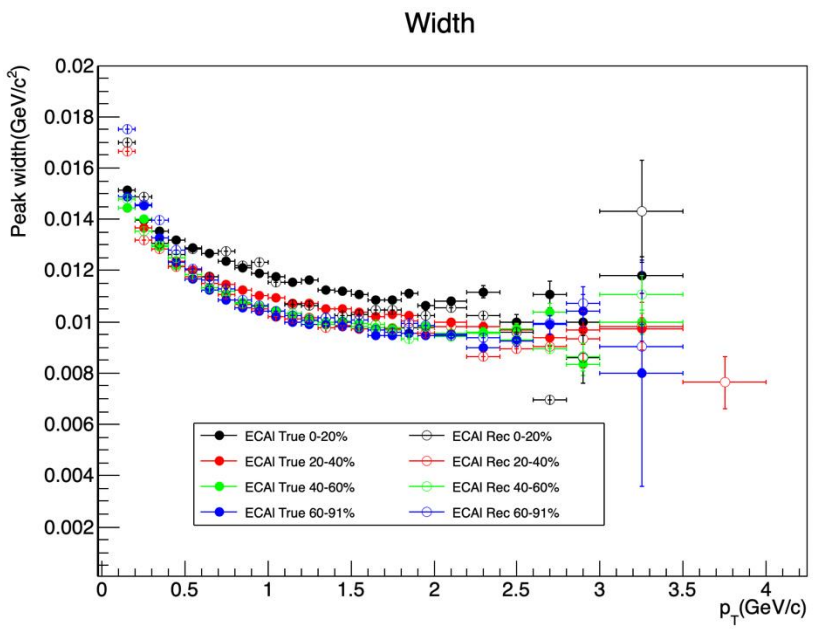


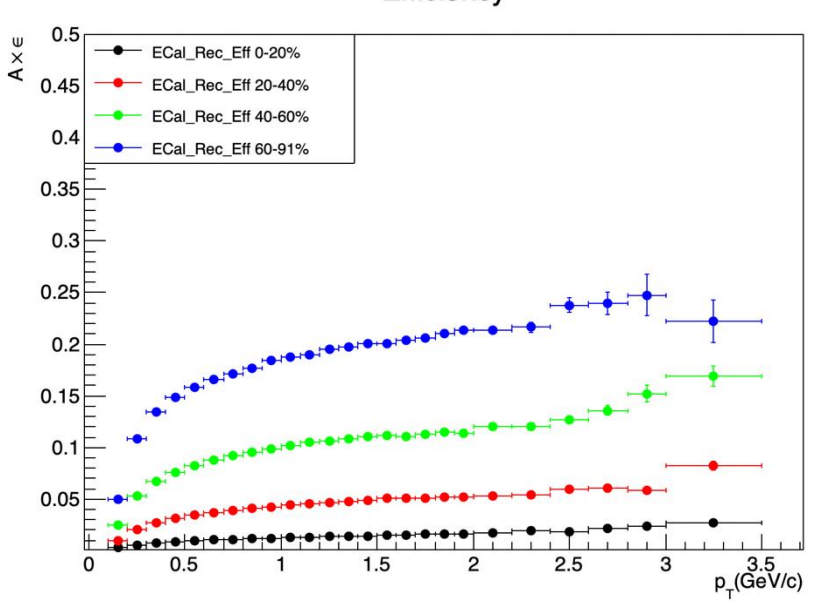


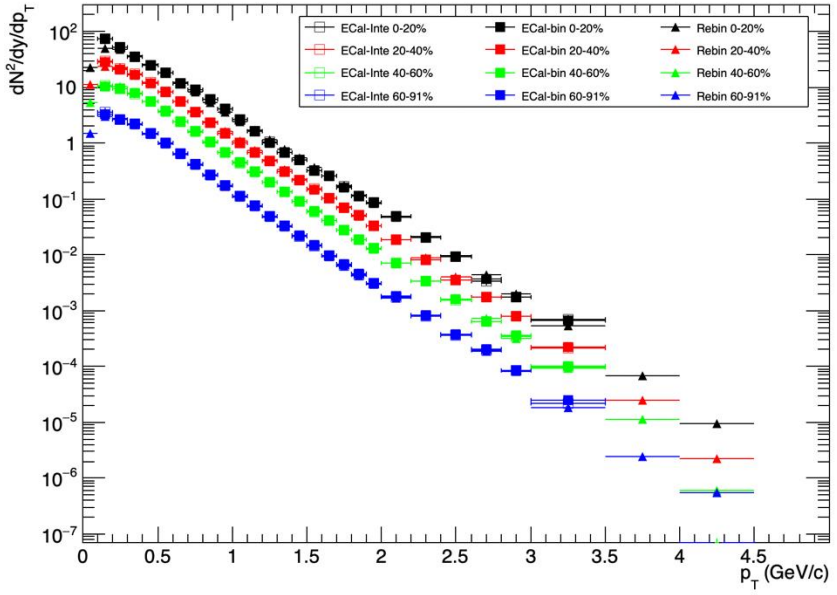
The results for reconstructed π^0 are consistent with the generated spectra in every centrality.

Centrality dependence of π^0 in ECal (Chi2 + Time + Match cut)









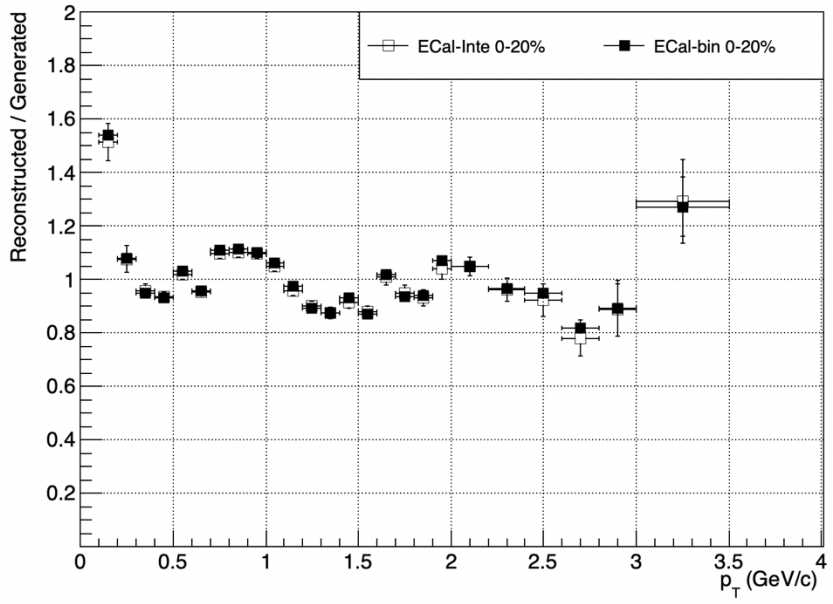
Photon cluster selection in ECal：

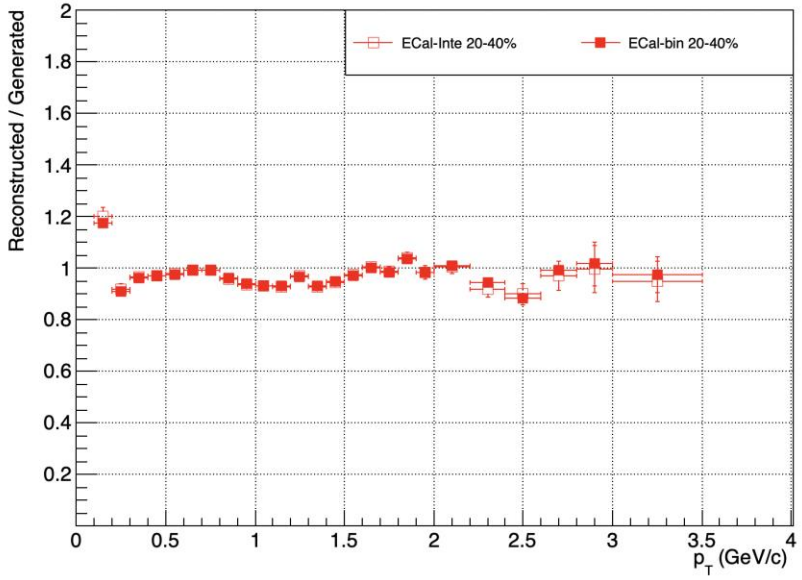
1、N_hit_tower>=2
2、reconstructed energy>=75MeV
3、Chi2<=4
4、tof<2ns
5、charged particle veto cut

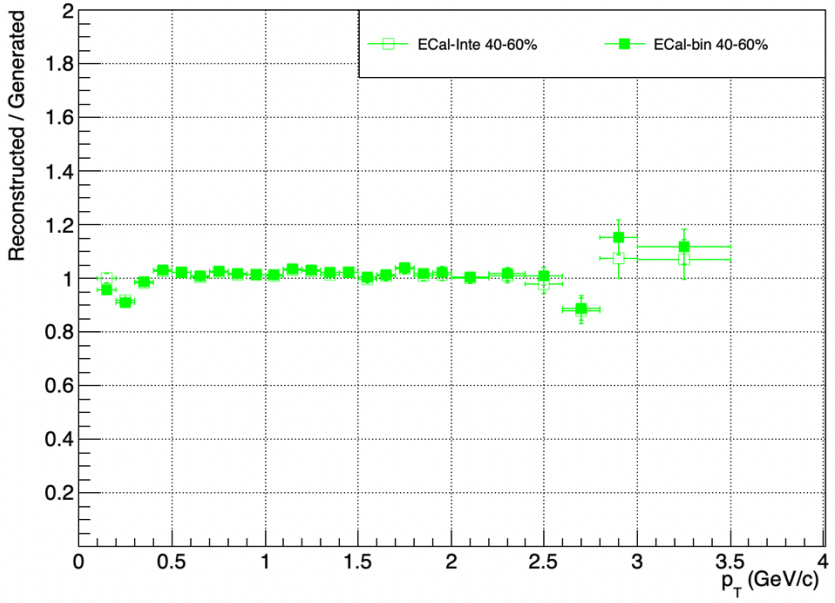
The invariant mass, peak width and yield of π^0 reconstructed and MC generated via two photons from ECal decrease as centrality increases within the same p_T range.

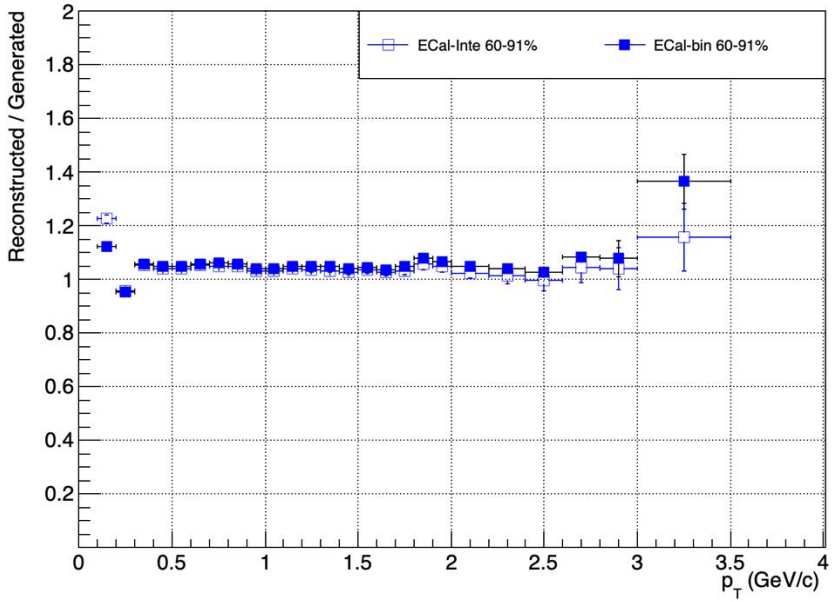
The reconstructed efficiency of π^0 in same p_T range increases with increasing centrality.

Centrality dependence of π^0 in ECal (Chi2 + Time + Match cut)





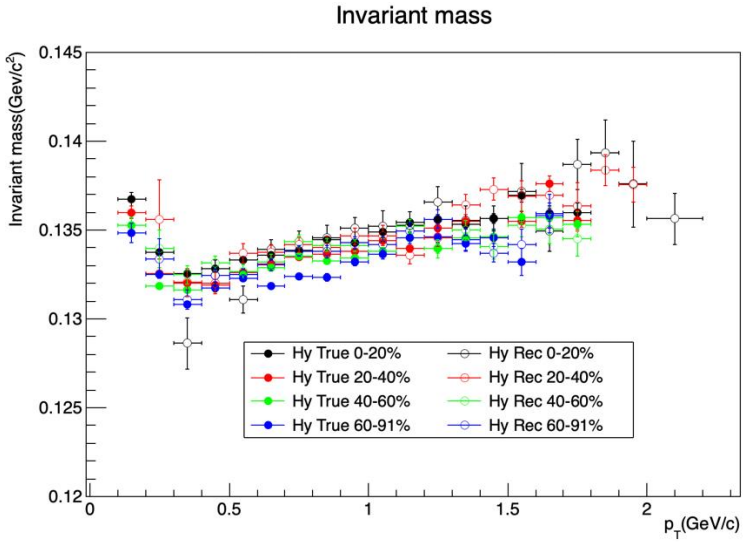


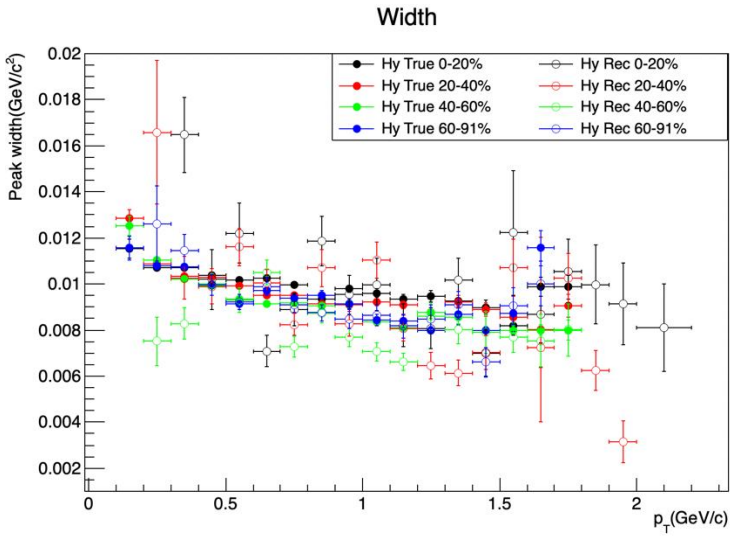


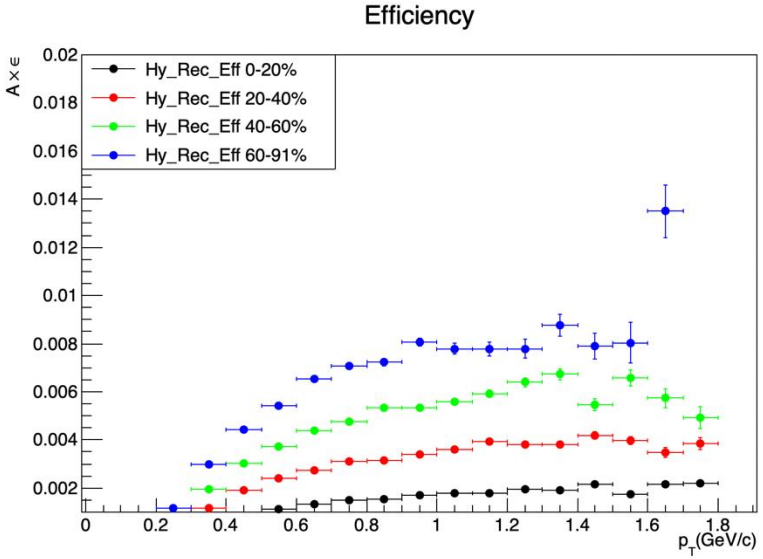
The results for reconstructed π^0 are consistent with the generated spectra in every centrality.

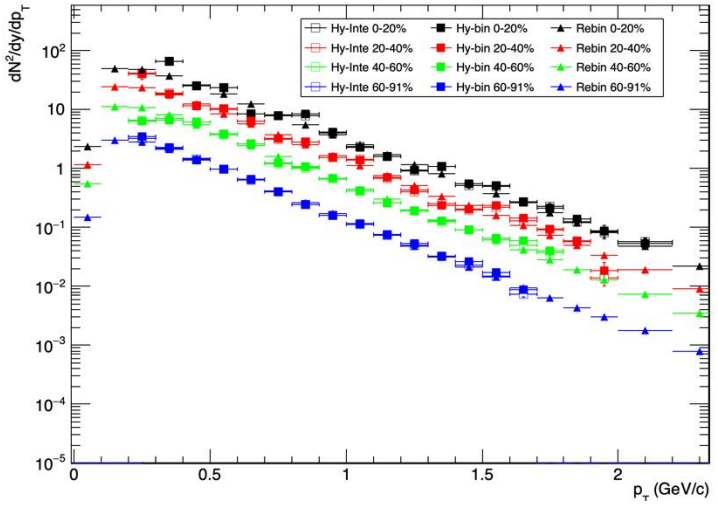
The yield ratio of reconstructed and generated of π^0 in centrality 0-20% is not better than other centralities.

Centrality dependence of π^0 in hybrid method









Data from Req9 input Req34

Photon cluster selection in ECal:

1、N_hit_tower>=2

2、reconstructed energy>=75MeV

3、Chi2<=4

4、tof<2ns

5、charged particle veto cut

The cuts of single $e^+(e^-)$ track for PCM:

1、nhit>10 in TPC

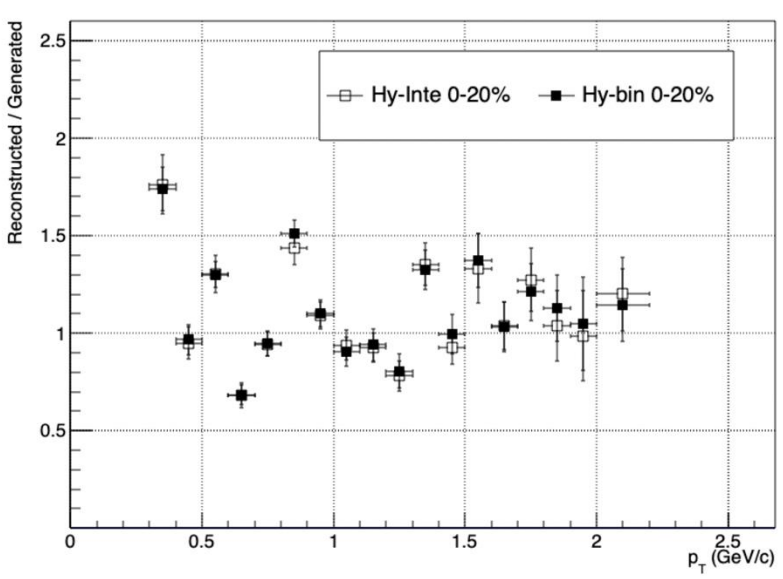
2、p_T > 50 MeV/c

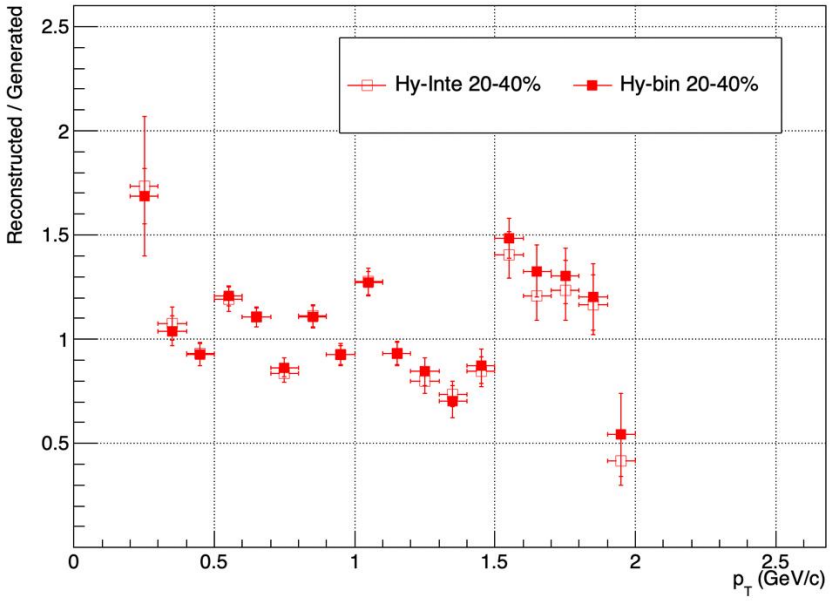
3、TPC 2-sigma e-ID or TPC 2-sigma eID + 3-sigma TOF e-ID in case of track matching to the TOF

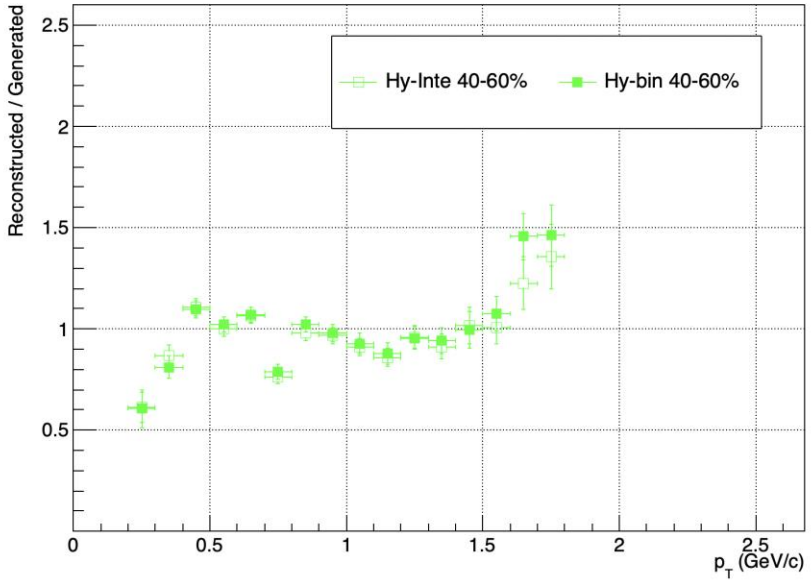
4、dca, Chi2, angle, decay length and mass 2*sigma cut for e^+e^- pair

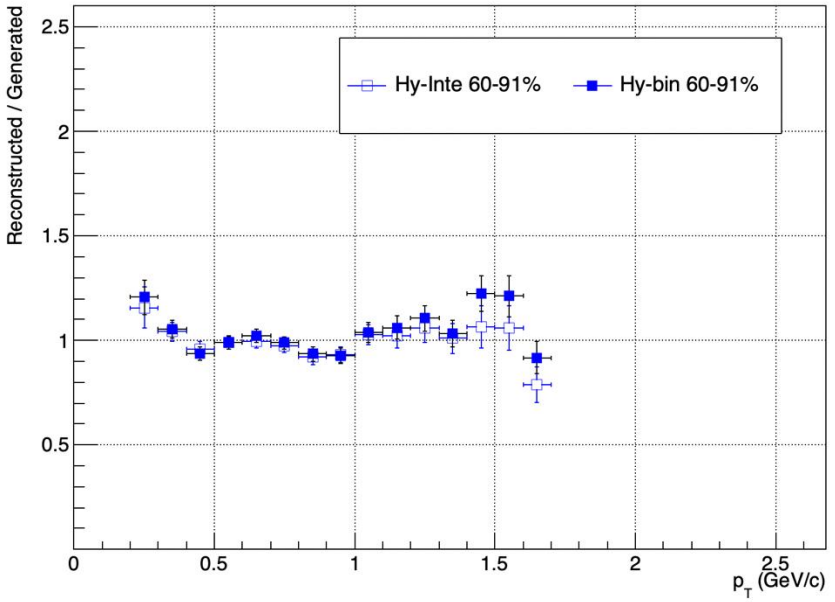
There is no significant centrality dependence observed in the invariant mass and peak width of π^0 reconstructed and MC generated via two photons from hybrid method.

Centrality dependence of π^0 in hybrid method









The yield ratio of reconstructed and generated of π^0 obtained by hybrid method is better with the increase of centrality.

Summary

1、The invariant mass π^0 reconstructed via two photons from ECal decreases as centrality increases over the same p_T range.

2、No significant centrality dependence is observed in the invariant mass of π^0 reconstructed via two photons in the hybrid method.

3、The centrality dependence study of π^0 reconstructed by PCM is ongoing.

4、The centrality dependence study of η is ongoing.

Summary

1、The invariant mass π^0 reconstructed via two photons from ECal decreases as centrality increases over the same p_T range.

2、No significant centrality dependence is observed in the invariant mass of π^0 reconstructed via two photons in the hybrid method.

3、The centrality dependence study of π^0 reconstructed by PCM is ongoing.

4、The centrality dependence study of $\boldsymbol{\eta}$ is ongoing.

Thanks!

Backup

Photon selection in ECAL

Photon cluster selection in ECAL：

1、N_hit_tower>=2

2、reconstructed energy>=75MeV

3、Chi2<=4(This variable says how close the cluster shape to the one expected for electromagnetic shower.)

4、tof<2ns(tof of the cluster, assumed ECAL time resolution dt = 0.5 ns)

5、charged particle veto cut (no matching to tracks reconstructed in the TPC and extrapolated to the ECAL)

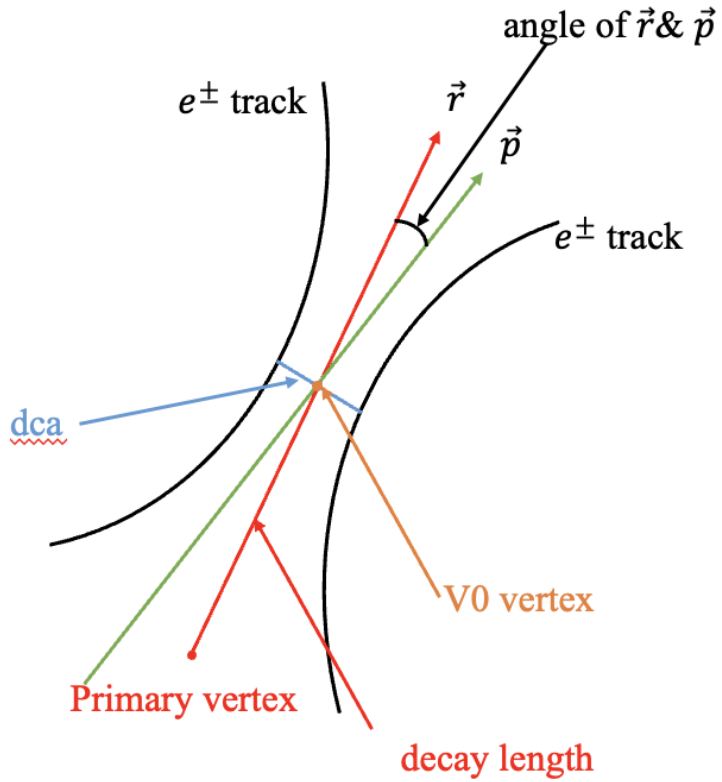
Photon selection in PCM

The cuts of single $e^+(e^-)$ track for PCM:

1、nhit>10 in TPC

2、p_T > 50 MeV/c

3、TPC 2-sigma e-ID or TPC 2-sigma eID + 3-sigma TOF e-ID in case of track matching to the TOF



e^+e^- pair's variables for PCM:

1、dca: distance of closest approach for e^+e^- tracks

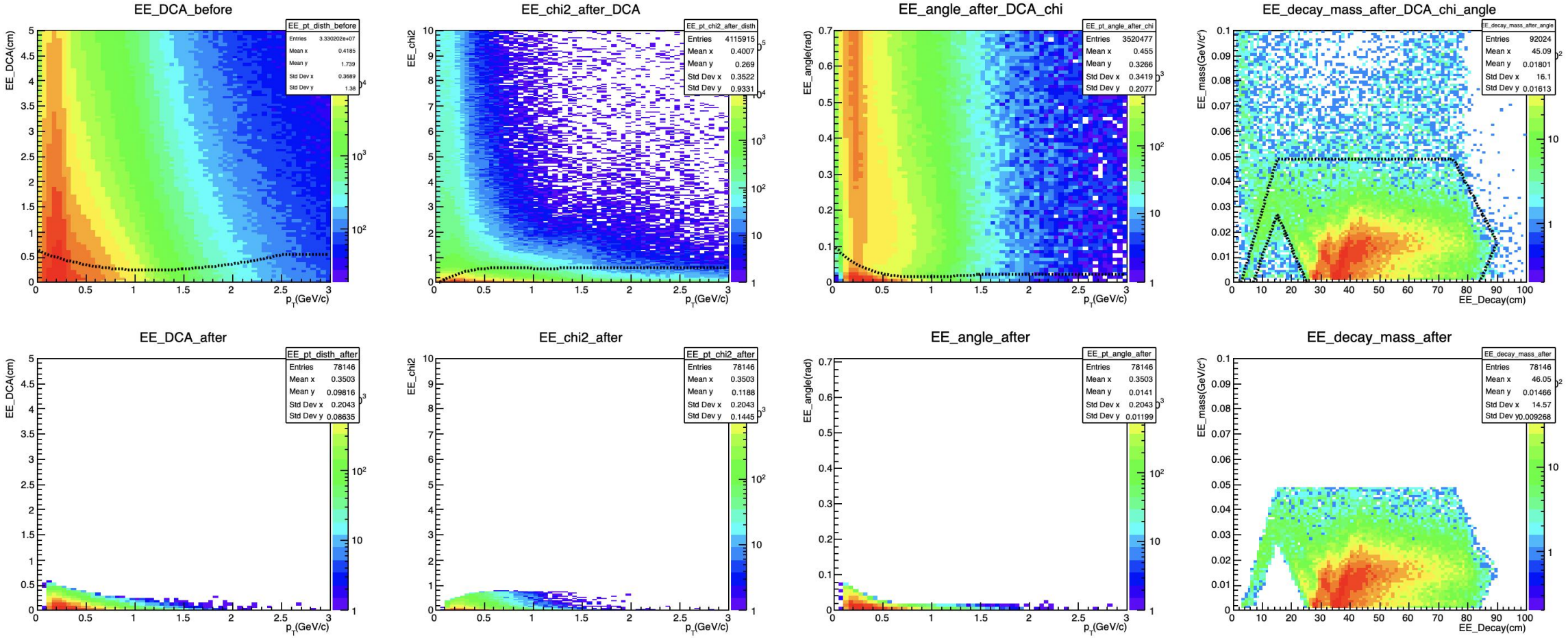
2、Chi2: quality of the secondary vertex reconstruction

3、angle: between $\vec{r}$ & $\vec{p}$

4、decay length: the distance from primary vertex to V0 vertex

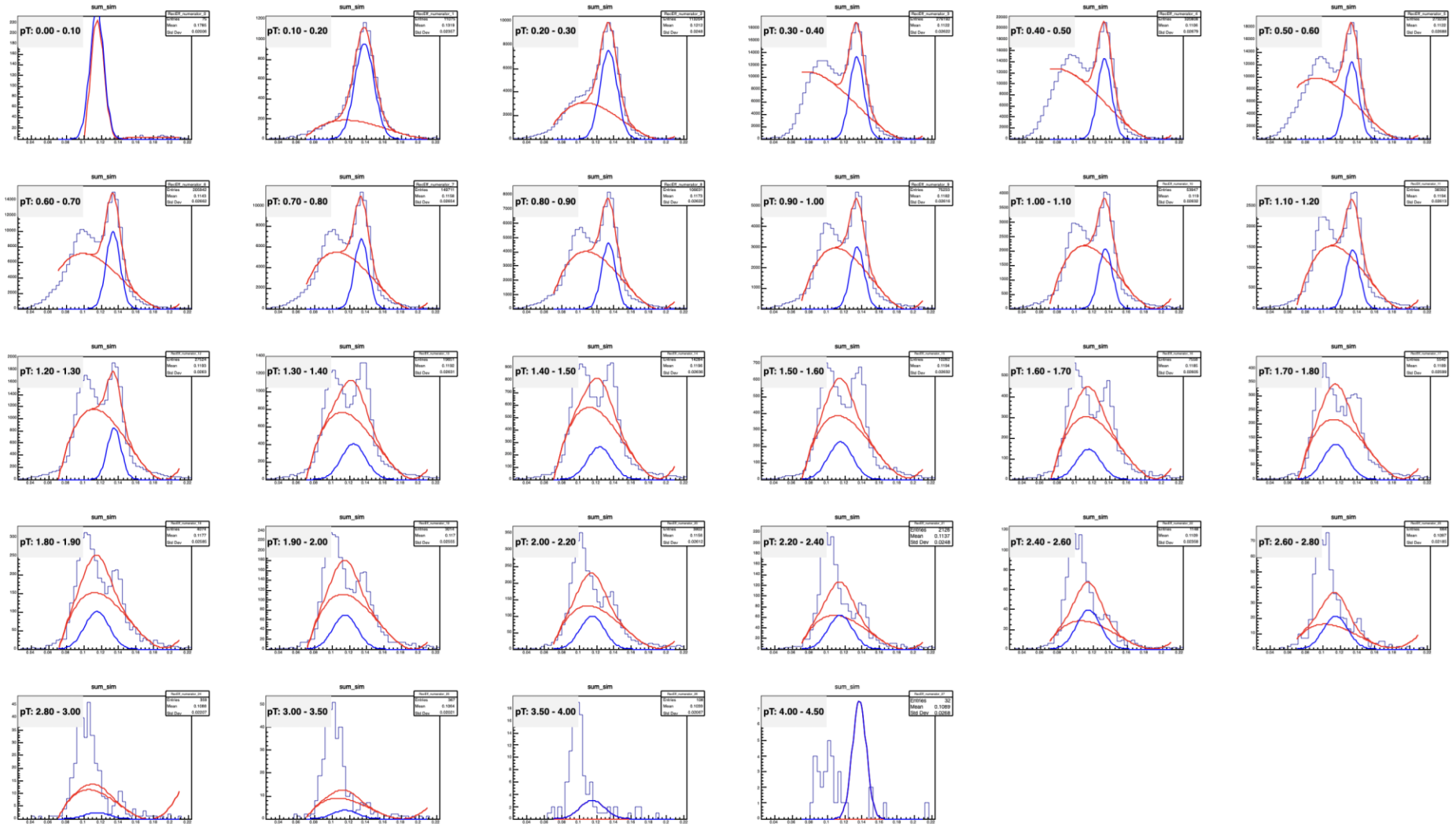
5、mass: the mass of mother particle of e^+e^- pair

e^+e^- pairs selection for PCM



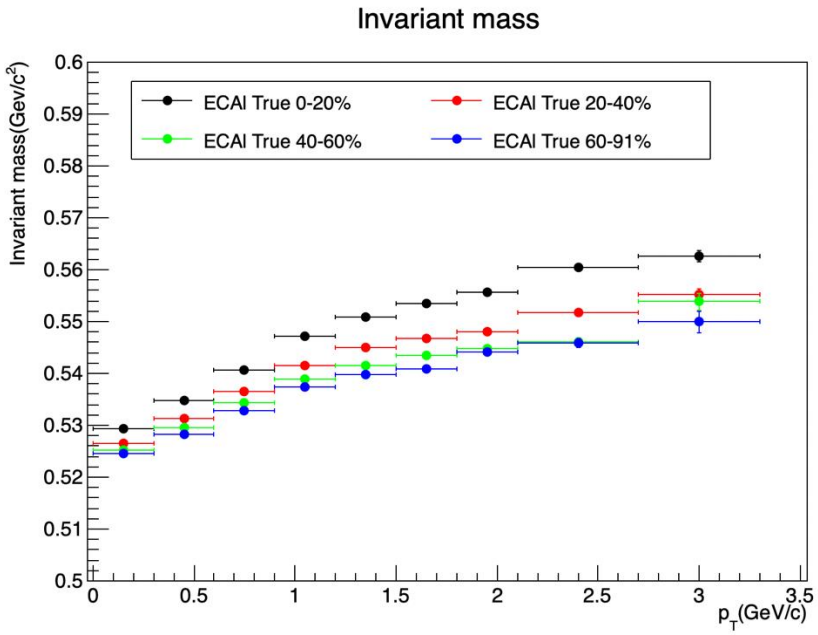
The upper are distributions of true conversion e^+e^- pairs.
The black dotted curves as 2*sigma selection, where sigma is either a Gaussian width (for distributions with Gaussian shape) or a range, which accounts for 65% of the total signal (2*sigma accounts for ~ 95% of the total signal).

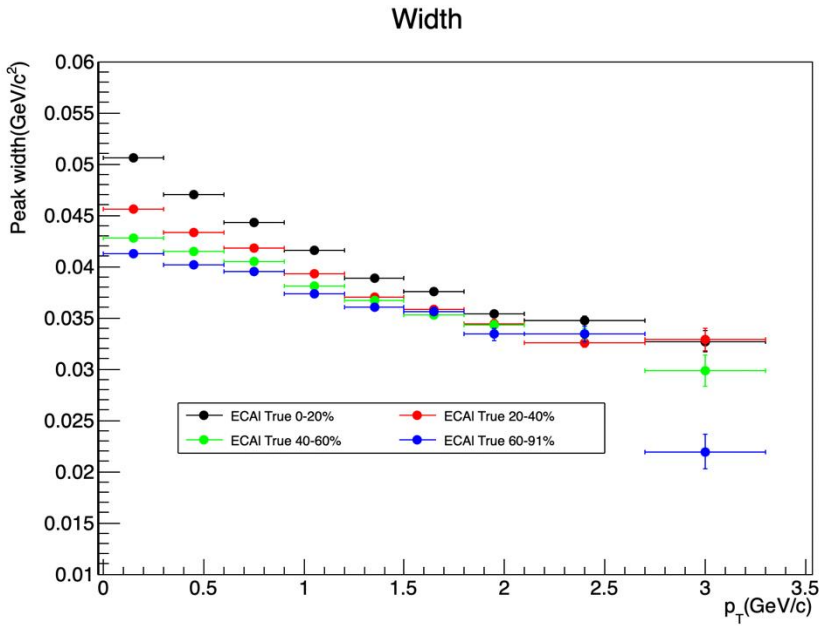
π^0 in Hybrid method(Chi+Time)

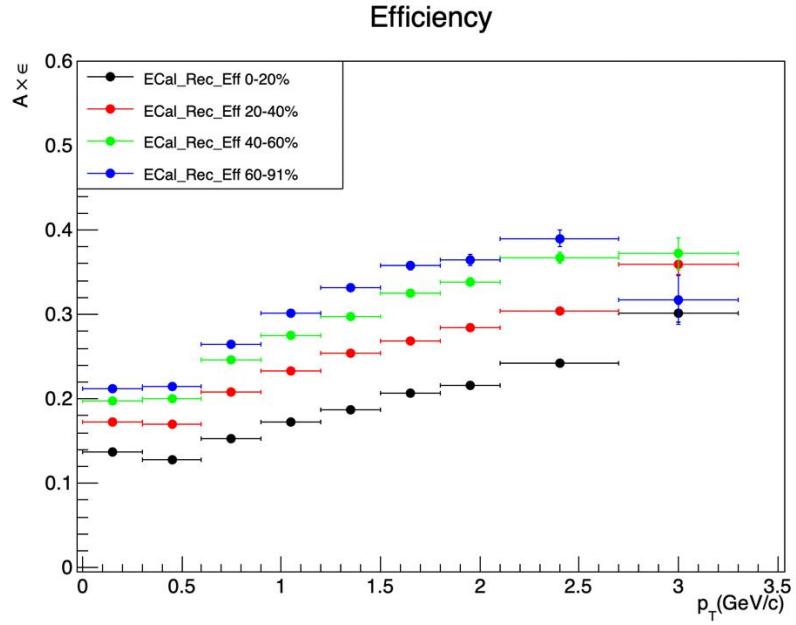


I try to draw the Hybrid result using the mInvTrueTimePIDPi0Bin_Hy_Centrality, this distribution is produced by the RecEffBins.C, it can‘t be used.

Centrality dependence of η in ECal







Photon cluster selection in ECal：

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2、reconstructed energy>=75MeV
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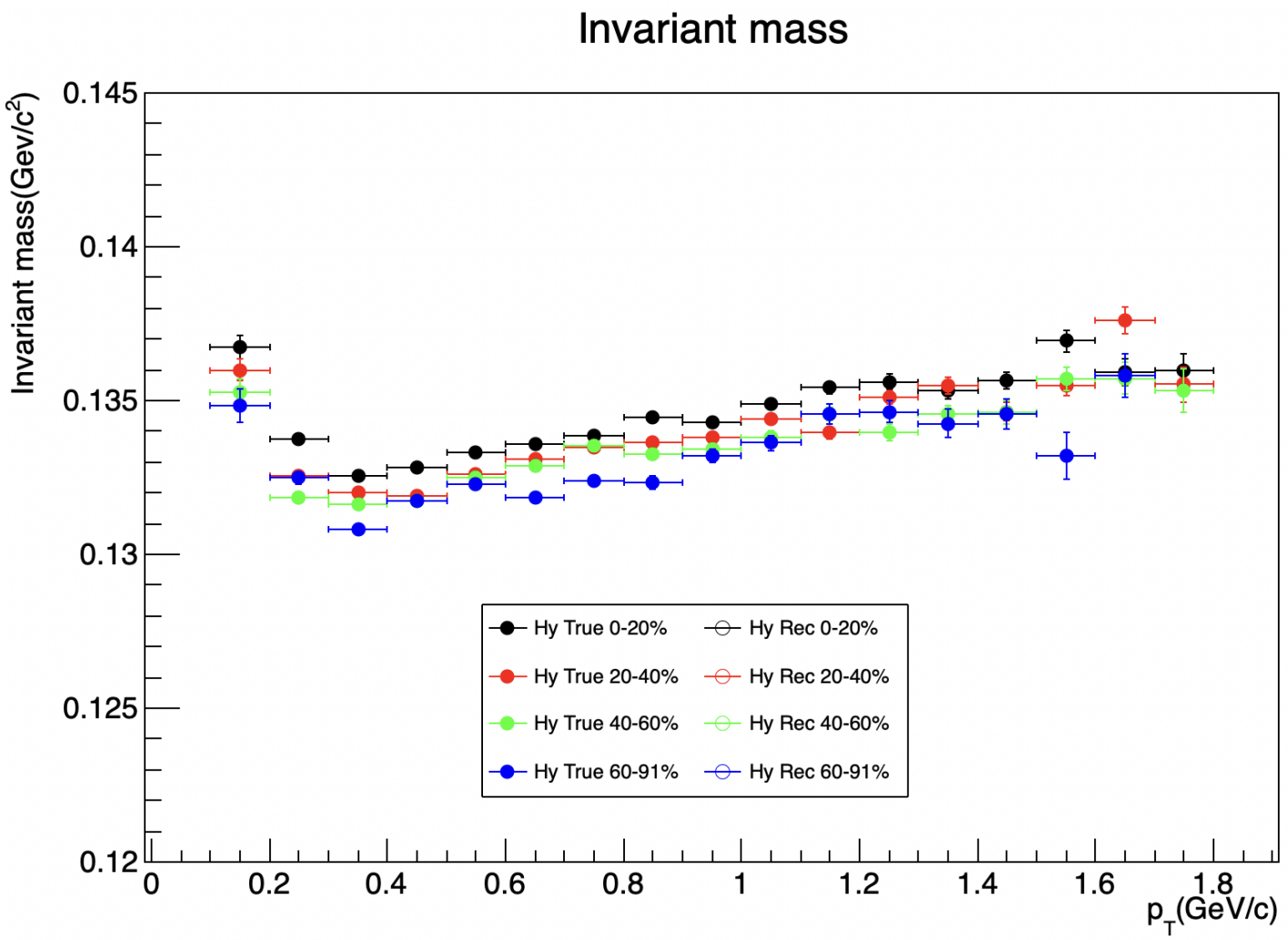
The invariant mass, peak width and yield of η reconstructed and MC generated via two photons from ECal decrease as centrality increases within the same p_T range.

The reconstructed efficiency of η in same p_T range increases with increasing centrality.


Invariant mass
Invariant mass(Gev/c^2)
0.145
0.14
0.135
0.13
0.125
0.12
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
p_T(GeV/c)
Hy True 0-20%
Hy Rec 0-20%
Hy True 20-40%
Hy Rec 20-40%
Hy True 40-60%
Hy Rec 40-60%
Hy True 60-91%
Hy Rec 60-91%