



## CEPC

Jets, samples and Wednesday working meeting Kaili Zhang <u>zhangkl@ihep.ac.cn</u>

## CEPCSW update



@Zhihao Li

- <u>https://code.ihep.ac.cn/cepc/CEPCSW/-/merge\_requests/248</u>
- Reduce rec momory.
- Decouple the geometry service.
- Need to re-organize the script order.
- (Not merged yet.) Under discussion.

Store EcalBar geometry meta data into root file.

- 1. root file size +~ 10KB
- 2. simulation mem usage: 3.10GB -> 3.80 GB
- 3. CyberPFA mem usage: -> 1.6GB



# Using Geliang's XGBoost PID on Hbb jet:

/hpcfs/cepc/higgsgpu/zhangkl/datasets0506/33\*bb.root 20000 jets

-> Dominant in Hqq environment

#### Eff\*Purity with uncertainty



Last week, the large uncertainty due to the entries scaled to event level. (O(1)). Now fixed. ~O(20000)

- 0.8

- 0.7

- 0.6

- 0.5

- 0.4

- 0.3

- 0.2

- 0.1

- 0.0

High eff\*purity found in "best" WP, which requires the maximum likelihood among 5 categories.

PID Efficiency*Purity														
۵-	0.478 ±0.004	0.509 ±0.004	0.509 ±0.004	0.503 ±0.004	0.500 ±0.004	0.493 ±0.004								
⊻ -	0.523 ±0.003	0.570 ±0.003	0.570 ±0.003	0.569 ±0.003	0.562 ±0.003	0.556 ±0.003								
Particle ID π -	0.579 ±0.001	0.824 ±0.001	0.852 ±0.001	0.850 ±0.001	0.898 ±0.001	0.861 ±0.001								
ω -	0.338 ±0.003	0.358 ±0.003	0.286 ±0.003	0.211 ±0.003	0.417 ±0.004	0								
ı-	0.064 ±0.001	0.163 ±0.003	0.167 ±0.003	0.115 ±0.003	0.441 ±0.006	0								
	98	90	70 Rec	50 o ID	best	nolep								



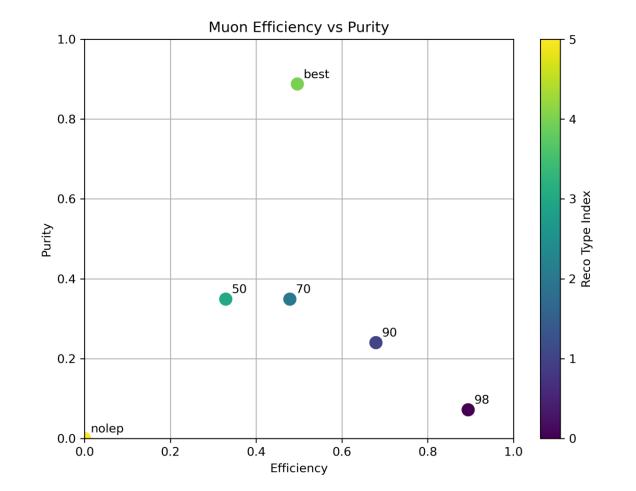
In this way, ~50Eff% and high Purity for e and muon. Even for those low energy leptons which lacks information.

			PID Eff	iciency			_			PID F	Purity			
۵ -	0.766 ±0.004	0.852 ±0.004	0.868 ±0.003	0.869 ±0.003	0.870 ±0.003	0.872 ±0.003	<u>م</u> - - 0.8	0.624 ±0.004	0.597 ±0.004	0.587 ±0.004	0.579 ±0.004	0.575 ±0.004	0.565 ±0.004	- 0.8
¥ -	0.671 ±0.003	0.759 ±0.003	0.767 ±0.003	0.769 ±0.003	0.772 ±0.003	0.778 ±0.003	⊻ - - 0.6	0.780 ±0.003	0.751 ±0.003	0.743 ±0.003	0.740 ±0.003	0.728 ±0.003	0.715 ±0.003	- 0.6
Particle ID π	0.600 ±0.001	0.864 ±0.001	0.907 ±0.001	0.916 ±0.001	0.947 ±0.001	0.959 ±0.000	ם ا Article P - 1- P - 0.4	0.965 ±0.001	0.954 ±0.001	0.940 ±0.001	0.928 ±0.001	0.948 ±0.001	0.897 ±0.001	- 0.4
a -	0.575 ±0.004	0.635 ±0.004	0.513 ±0.004	0.406 ±0.004	0.565 ±0.004	0	υ - - 0.2	0.589 ±0.004	0.564 ±0.004	0.558 ±0.004	0.519 ±0.005	0.737 ±0.004	0	- 0.2
크 -	0.894 ±0.004	0.679 ±0.006	0.479 ±0.006	0.329 ±0.006	0.496 ±0.006	0	- 0.2 ユ -	0.072 ±0.001	0.240 ±0.003	0.349 ±0.005	0.349 ±0.006	0.888 ±0.005	0	- 0.0
	98	90	70 Rec	50 o ID	best	nolep	- 0.0	98	90	70 Rec	50 o ID	best	nolep	- 0.0

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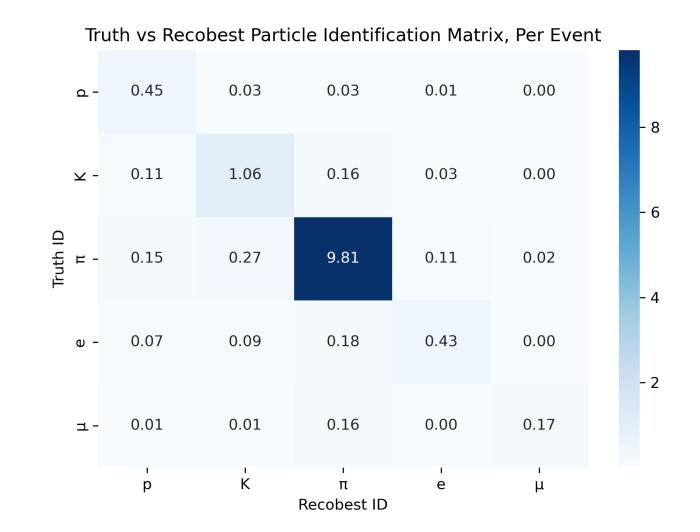
#### Maximum likelihood: best WP.





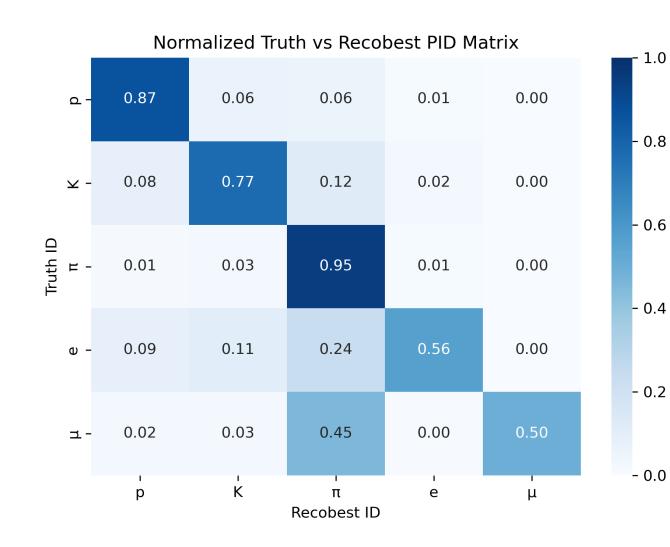
#### Confusion matrix, scale by one event.





### Confusion matrix, scale by category





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	Clear separation between p/k/pi to e/mu.
3	Clear sepraration between e/muon
5	Very low contamination ratio for pion->muon, even for low energy.

Muon eff ~50% and ~50% failed to Pion.

## **JOI** Application

CEPC

Use 1M sample training. Not application.

	XGBoost Best WP, RefTDR, ParT														
- م	0.809	0.127	0.019	0.018	0.002	0.001	0.001	0.002	0.001	0.001	0.021				
- <u>م</u>	0.127	0.810	0.017	0.018	0.001	0.002	0.002	0.001	0.001	0.001	0.021				
υ -	0.009	0.010	0.791	0.043	0.018	0.025	0.023	0.004	0.005	0.014	0.058				
- U	0.010	0.009	0.044	0.790	0.023	0.017	0.005	0.022	0.014	0.005	0.059				
v -	0.002	0.001	0.014	0.019	0.474	0.082	0.022	0.106	0.080	0.047	0.154				
True <sup>s</sup>	0.001	0.001	0.018	0.014	0.078	0.480	0.107	0.022	0.046	0.077	0.156				
<b>-</b> כ	0.001	0.001	0.019	0.008	0.035	0.138	0.375	0.035	0.061	0.161	0.168				
- כי	0.001	0.001	0.007	0.020	0.135	0.035	0.036	0.368	0.167	0.060	0.169				
- ס	0.001	0.001	0.009	0.017	0.120	0.076	0.056	0.207	0.271	0.067	0.175				
- סי	0.001	0.001	0.017	0.009	0.075	0.122	0.213	0.052	0.068	0.266	0.176				
<b>ს</b> -		0.009													
	b	Ē	C	ċ	ı S	ŝ	u U	ū	d	å	Ġ				

Predicted

XGBest: 0.5545.

 Slightly better

 than Reco70.

 Past:

 Truth:
 0.5936

 Reco70:
 0.5510

 Nolep:
 0.5494

 Reco98:
 0.5153

 NoID:
 0.4825

- 0.2

- 0.7

- 0.6

- 0.5

- 0.4

- 0.3

- 0.1



XG\_Best gets lower s eff but higher gluon eff compared to Reco70. However, the PID improvement leads to small impact on JOI.

ParT_TruthID																		ParT	_Recol	D70				
b -	0.832	0.113	0.019	0.016	0.002	0.001	0.001	0.002	0.001	0.001	0.012	b	- 0.80	06 0.13	3 0	0.020	0.019	0.002	0.001	0.001	0.002	0.001	0.001	0.013
bbar -	0.113	0.831	0.016	0.018	0.001	0.002	0.002	0.001	0.001	0.002	0.012	bbar	- 0.13	3 0.80	5 0	0.020	0.020	0.002	0.002	0.002	0.001	0.001	0.001	0.013
c -	0.009	0.009	0.822	0.034	0.024	0.024	0.023	0.005	0.006	0.014	0.030	с	- 0.00	9 0.01	2 0	).792	0.047	0.021	0.028	0.026	0.006	0.007	0.016	0.036
cbar -	0.009	0.009	0.035	0.820	0.024	0.024	0.005	0.023	0.016	0.006	0.030	cbar	- 0.01	.2 0.00	9 0	0.048	0.789	0.029	0.021	0.006	0.025	0.017	0.007	0.037
S -	0.002	0.001	0.015	0.017	0.584	0.081	0.023	0.085	0.081	0.042	0.069	s	- 0.00	0.00	1 0	0.016	0.021	0.503	0.094	0.025	0.115	0.085	0.052	0.087
- Iruth Truth	0.001	0.001	0.015	0.016	0.079	0.586	0.087	0.023	0.046	0.076	0.070	با Apart	- 0.00	0.00	2 0	0.020	0.016	0.089	0.504	0.120	0.025	0.052	0.084	0.087
u -	0.001	0.002	0.018	0.006	0.029	0.114	0.440	0.044	0.079	0.183	0.085	u	- 0.00	01 0.00	2 0	).022	0.009	0.040	0.153	0.396	0.039	0.068	0.175	0.094
ubar -	0.002	0.001	0.007	0.018	0.115	0.031	0.048	0.422	0.202	0.071	0.084	ubar	- 0.00	0.00	1 0	0.009	0.023	0.153	0.040	0.042	0.390	0.178	0.067	0.095
d -	0.001	0.001	0.009	0.016	0.096	0.074	0.072	0.212	0.362	0.071	0.086	d	- 0.00	0.00	1 0	0.011	0.022	0.130	0.087	0.065	0.229	0.283	0.076	0.096
dbar -	0.001	0.001	0.016	0.009	0.074	0.099	0.233	0.067	0.079	0.334	0.087	dbar	- 0.00	0.00	2 0	0.021	0.011	0.087	0.134	0.235	0.058	0.078	0.275	0.097
g -	0.012	0.012	0.028	0.027	0.075	0.075	0.076	0.071	0.067	0.060	0.498	g	- 0.01	.2 0.01	2 0	0.031	0.030	0.077	0.079	0.069	0.067	0.055	0.052	0.517
	\$	bbat	C	<b>Upar</b>	5 F	په <sup>مر</sup> Predicted	ہٰ d	Jpar	ò	dbat	\$	-	Å.	<sup>000</sup>		L C	Coat	5 F	پې <sup>مر</sup> Predicted	ہٰ ط	upat	ò	abat	\$

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#### To dos



- Further study the JOI Impact parameters. (VTX, PID)
- Test applications on Zqq, E360, cases like 4j.
- Write universal package to use. (Under construction)