

Update on Tracking Performances for TDR

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11.2.2 Main requirements and acceptance coverage

Yellow Report

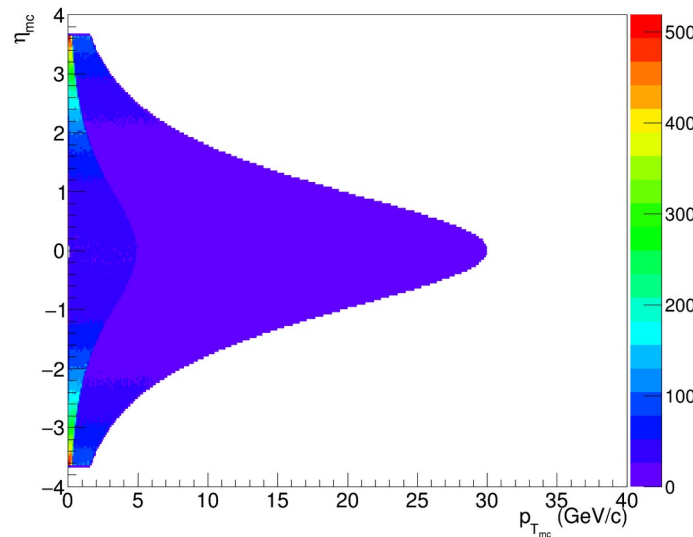
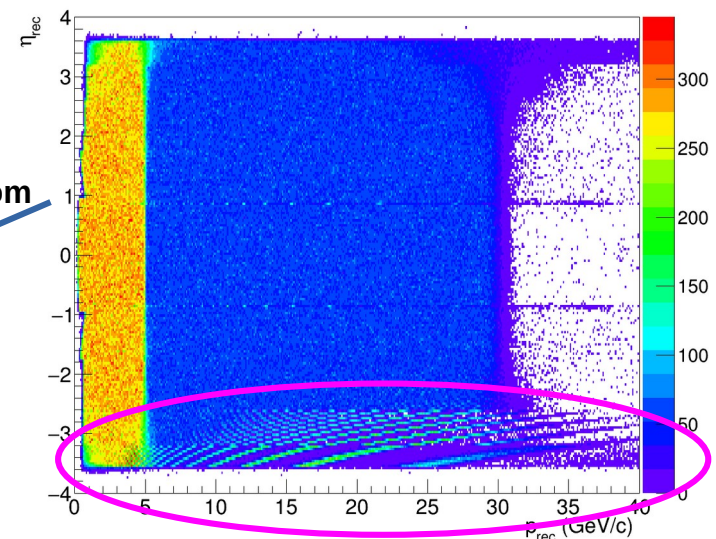
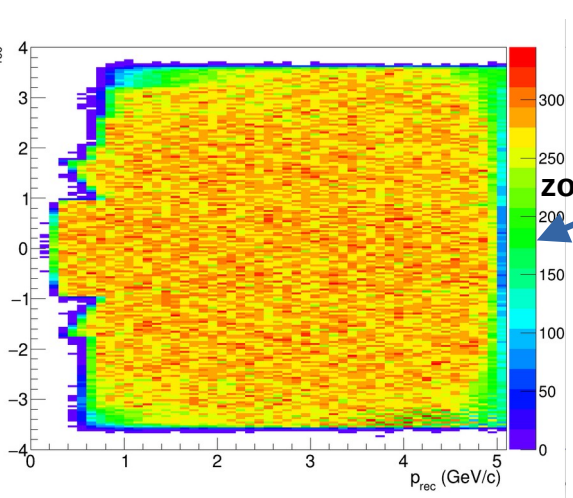
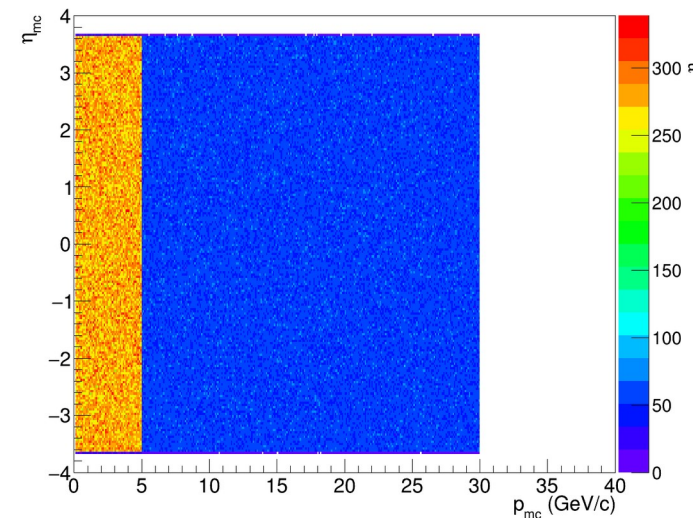
Table 11.2: Requirements for the tracking system from the physics groups.

Tracking requirements from PWGs						
η			Momentum res.	Material budget	Minimum pT	Transverse pointing res.
-3.5 to -3.0	Backward Detector		$\sigma/p \sim 0.1\% \times p \oplus 0.5\%$		100-150 MeV/c	$dca(xy) \sim 30/pT \mu\text{m} \oplus 40 \mu\text{m}$
-3.0 to -2.5					100-150 MeV/c	
-2.5 to -2.0					100-150 MeV/c	
-2.0 to -1.5					100-150 MeV/c	
-1.5 to -1.0					100-150 MeV/c	
-1.0 to -0.5	Central Detector	Barrel	$\sigma/p \sim 0.05\% \times p \oplus 0.5\%$	~5% X0 or less	100-150 MeV/c	$dca(xy) \sim 20/pT \mu\text{m} \oplus 5 \mu\text{m}$
-0.5 to 0						
0 to 0.5						
0.5 to 1.0						
1.0 to 1.5						
1.5 to 2.0	Forward Detector		$\sigma/p \sim 0.05\% \times p \oplus 1\%$		100-150 MeV/c	$dca(xy) \sim 30/pT \mu\text{m} \oplus 20 \mu\text{m}$
2.0 to 2.5					100-150 MeV/c	
2.5 to 3.0					100-150 MeV/c	
2.5 to 3.0					100-150 MeV/c	
3.0 to 3.5					100-150 MeV/c	
3.0 to 3.5			$\sigma/p \sim 0.1\% \times p \oplus 2\%$		100-150 MeV/c	$dca(xy) \sim 30/pT \mu\text{m} \oplus 60 \mu\text{m}$

Update on Tracking Performances

➤ Simulation of 5M π^+ completed for momentum [0.1,30.] GeV/c and η [-3.5,3.5]

epic_craterlake_tracking_only



Structures reported previously

$$\eta = -\ln[\tan(\theta/2)]$$

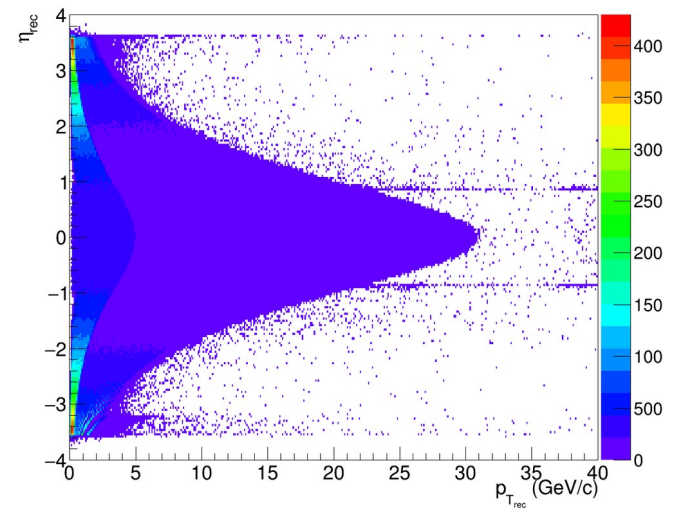
$$pz = p \cos(\theta)$$

etamc = -

```
1.0*TMath::Log(TMath::Tan((TMath::ACos(pz_mc[
iParticle]/pmc))/2));
```

etarec = -

```
1.0*TMath::Log(TMath::Tan((TMath::ACos(pz_rec[
iParticle]/prec))/2));
```



Matching Flag for Realistic Seeding

```

root [3] events-
>Scan("sqrt(ReconstructedSeededChargedParticles.momentum.x*ReconstructedSeededChargedParticles.momentum.x+ReconstructedSeededChargedPar
ticles.momentum.y*ReconstructedSeededChargedParticles.momentum.y+ReconstructedSeededChargedParticles.momentum.z*ReconstructedSeededChar
gedParticles.momentum.z):ReconstructedSeededChargedParticles.type")

```

Reconstructed Particle

* Event *	* TrackId *	* Momentum *	* Type
* 0 *	* 0 *	* 13.498426 *	* 0 *
* 0 *	* 1 *	* 13.498392 *	* -1 *
* 0 *	* 2 *	* 13.498411 *	* -1 *
* 0 *	* 3 *	* 13.499280 *	* -1 *
* 1 *	* 0 *	* 2.4141976 *	* 0 *
* 1 *	* 1 *	* 2.4142137 *	* -1 *
* 2 *	* 0 *	* 19.535115 *	* 0 *
* 2 *	* 1 *	* 19.537167 *	* -1 *
* 2 *	* 2 *	* 19.538023 *	* -1 *
* 2 *	* 3 *	* 19.544823 *	* -1 *
* 2 *	* 4 *	* 19.541878 *	* -1 *
* 3 *	* 0 *	* 5.2754213 *	* 0 *
* 3 *	* 1 *	* 5.5917249 *	* -1 *
* 4 *	* 0 *	* 5.8057297 *	* 0 *
* 4 *	* 1 *	* 5.8055990 *	* -1 *
* 4 *	* 2 *	* 5.8055911 *	* -1 *
* 5 *	* 0 *	* 25.311133 *	* 0 *
* 5 *	* 1 *	* 24.678096 *	* -1 *
* 5 *	* 2 *	* 11.736989 *	* -1 *
* 5 *	* 3 *	* 22.583210 *	* -1 *
* 6 *	* 0 *	* 29.095495 *	* 0 *
* 6 *	* 1 *	* 29.093903 *	* -1 *
* 6 *	* 2 *	* 29.100129 *	* -1 *
* 6 *	* 3 *	* 3.5652525 *	* -1 *
* 6 *	* 4 *	* 29.064649 *	* -1 *
* 7 *	* 0 *	* 7.7681241 *	* 0 *
* 7 *	* 1 *	* 7.7689891 *	* -1 *
* 7 *	* 2 *	* 7.7690803 *	* -1 *
* 8 *	* 0 *	* 7.3753309 *	* 0 *
* 8 *	* 1 *	* 7.3798371 *	* -1 *
* 9 *	* 0 *	* 29.347083 *	* 0 *
* 9 *	* 1 *	* 29.347463 *	* -1 *
* 9 *	* 2 *	* 29.347459 *	* -1 *
* 10 *	* 0 *	* 1.7539496 *	* 0 *
* 10 *	* 1 *	* 1.7572962 *	* -1 *
* 10 *	* 2 *	* 2.7594797 *	* -1 *
* 11 *	* 0 *	* 1.0826639 *	* 0 *
* 11 *	* 1 *	* 1.4650746 *	* -1 *
* 11 *	* 2 *	* 1.2057601 *	* -1 *
* 12 *	* 0 *	* 0.7757880 *	* 0 *
* 12 *	* 1 *	* 0.7757874 *	* -1 *
* 12 *	* 2 *	* 0.7757716 *	* -1 *
* 13 *	* 0 *	* 27.472239 *	* 0 *
* 13 *	* 1 *	* 27.49686 *	* -1 *
* 13 *	* 2 *	* 4.0156199 *	* -1 *
* 13 *	* 3 *	* 27.152967 *	* -1 *
* 14 *	* 0 *	* 22.791081 *	* 0 *
* 14 *	* 1 *	* 22.788940 *	* -1 *
* 14 *	* 2 *	* 22.78891 *	* -1 *
* 15 *	* 0 *	* 5.5802806 *	* 0 *

Reconstructed particle uses
0 flag for matched particle
(it's first element of array) is
not required

Track parameters have
always 0 flag (first element of
array is the matched one)

Track Parameters: $(l_0, l_1, \theta, \phi, 1/p)$

$l_0 \rightarrow DCA_{xy}$

$l_1 \rightarrow DCA_z$

$$p = 1./(1/p)$$

$$p_z = p \cos\theta$$

$$p_T = \sqrt{p^2 - p_z^2}$$

$$p_x = p_T \cos\phi$$

$$p_y = p_T \sin\phi$$

```

root [2]
events->Scan("/CentralCKFSeededTrackParameters.qOverP:CentralCKFSeede
dTrackParameters.type")

```

Track Parameters

* Event *	* TrackId *	* Momentum *	* Type *
* 0 *	* 0 *	* 13.498426 *	* 0 *
* 0 *	* 1 *	* 13.498392 *	* 0 *
* 0 *	* 2 *	* 13.498411 *	* 0 *
* 0 *	* 3 *	* 13.499280 *	* 0 *
* 1 *	* 0 *	* 2.4141975 *	* 0 *
* 1 *	* 1 *	* 2.4142137 *	* 0 *
* 2 *	* 0 *	* 19.535116 *	* 0 *
* 2 *	* 1 *	* 19.537168 *	* 0 *
* 2 *	* 2 *	* 19.538022 *	* 0 *
* 2 *	* 3 *	* 19.544822 *	* 0 *
* 2 *	* 4 *	* 19.541877 *	* 0 *
* 3 *	* 0 *	* 5.2754215 *	* 0 *
* 3 *	* 1 *	* 5.5917250 *	* 0 *
* 4 *	* 0 *	* 5.8057296 *	* 0 *
* 4 *	* 1 *	* 5.8055990 *	* 0 *
* 4 *	* 2 *	* 5.8055909 *	* 0 *
* 5 *	* 0 *	* 25.311133 *	* 0 *
* 5 *	* 1 *	* 24.678096 *	* 0 *
* 5 *	* 2 *	* 11.736989 *	* 0 *
* 5 *	* 3 *	* 22.583211 *	* 0 *
* 6 *	* 0 *	* 29.095496 *	* 0 *
* 6 *	* 1 *	* 29.093903 *	* 0 *
* 6 *	* 2 *	* 29.100129 *	* 0 *
* 6 *	* 3 *	* 3.5652526 *	* 0 *
* 6 *	* 4 *	* 29.064648 *	* 0 *
* 7 *	* 0 *	* 7.7681242 *	* 0 *
* 7 *	* 1 *	* 7.7689893 *	* 0 *
* 7 *	* 2 *	* 7.7690801 *	* 0 *
* 8 *	* 0 *	* 7.3753306 *	* 0 *
* 8 *	* 1 *	* 7.3798368 *	* 0 *
* 9 *	* 0 *	* 29.347083 *	* 0 *
* 9 *	* 1 *	* 29.347462 *	* 0 *
* 9 *	* 2 *	* 29.347459 *	* 0 *
* 10 *	* 0 *	* 1.7539496 *	* 0 *
* 10 *	* 1 *	* 1.7572961 *	* 0 *
* 10 *	* 2 *	* 2.7594797 *	* 0 *
* 11 *	* 0 *	* 1.0826638 *	* 0 *
* 11 *	* 1 *	* 1.4650746 *	* 0 *
* 11 *	* 2 *	* 1.2057601 *	* 0 *
* 12 *	* 0 *	* 0.7757880 *	* 0 *
* 12 *	* 1 *	* 0.7757874 *	* 0 *
* 12 *	* 2 *	* 0.7757717 *	* 0 *
* 13 *	* 0 *	* 27.472239 *	* 0 *
* 13 *	* 1 *	* 27.49686 *	* 0 *
* 13 *	* 2 *	* 4.0156199 *	* 0 *
* 13 *	* 3 *	* 27.152967 *	* 0 *
* 14 *	* 0 *	* 22.791081 *	* 0 *
* 14 *	* 1 *	* 22.788941 *	* 0 *
* 14 *	* 2 *	* 22.788910 *	* 0 *
* 15 *	* 0 *	* 5.5802807 *	* 0 *

Matching Flag for Truth Seeding

root [4]

events->Scan("1./CentralCKFTrackParameters.qOverP:CentralCKFTrackParameters.type")

Row	Instance	1./Centra	CentralCK					
*	0 *	0 *	13.498378 *	0 *	*	23 *	0 * 18.828869 *	0 *
*	1 *	0 *	2.4141702 *	0 *	*	24 *	0 * 7.1995501 *	0 *
*	2 *	0 *	19.535541 *	0 *	*	25 *	0 * 27.645577 *	0 *
*	3 *	0 *	5.6013352 *	0 *	*	26 *	0 * 3.3905160 *	0 *
*	4 *	0 *	5.8056567 *	0 *	*	27 *	0 * 0.5135805 *	0 *
*	5 *	0 *	22.711303 *	0 *	*	28 *	0 * 10.359597 *	0 *
*	6 *	0 *	29.096622 *	0 *	*	29 *	0 * 24.395857 *	0 *
*	7 *	0 *	7.7685216 *	0 *	*	30 *	0 * 9.6063050 *	0 *
*	8 *	0 *	7.3730658 *	0 *	*	31 *	0 * *	*
*	9 *	0 *	29.347359 *	0 *	*	32 *	0 * 4.6145223 *	0 *
*	10 *	0 *	1.7499548 *	0 *	*	33 *	0 * 28.705787 *	0 *
*	11 *	0 *	1.0827484 *	0 *	*	34 *	0 * 5.8230717 *	0 *
*	12 *	0 *	0.7686298 *	0 *	*	35 *	0 * 10.389156 *	0 *
*	13 *	0 *	27.453415 *	0 *	*	36 *	0 * 15.008906 *	0 *
*	14 *	0 *	22.788581 *	0 *	*	37 *	0 * 22.254867 *	0 *
*	15 *	0 *	5.5796785 *	0 *	*	38 *	0 * 18.202116 *	0 *
*	16 *	0 *	18.298533 *	0 *	*	39 *	0 * 4.7689675 *	0 *
*	17 *	0 *	27.304958 *	0 *	*	40 *	0 * 16.575052 *	0 *
*	18 *	0 *	27.921491 *	0 *	*	41 *	0 * -1.780636 *	0 *
*	19 *	0 *	2.3859092 *	0 *	*	42 *	0 * 9.2958878 *	0 *
*	20 *	0 *	29.128252 *	0 *	*	43 *	0 * 14.811142 *	0 *
*	21 *	0 *	23.156440 *	0 *	*	44 *	0 * 21.525357 *	0 *
*	22 *	0 *	0.7287343 *	0 *	*	45 *	0 * 17.757532 *	0 *
					*	46 *	0 * 19.507493 *	0 *
					*	47 *	0 * 16.948814 *	0 *
					*	48 *	0 * 19.977849 *	0 *
					*	49 *	0 * 18.967170 *	0 *

Truth seeding showing one reco track

Track Parameters: $(l_0, l_1, \theta, \phi, 1/p)$

$l_0 \rightarrow DCA_{xy}$

$l_1 \rightarrow DCA_z$

$$p = 1./(1/p) \qquad p_z = p \cos\theta$$

$$p_T = \sqrt{p^2 - p_z^2} \qquad p_x = p_T \cos\phi$$

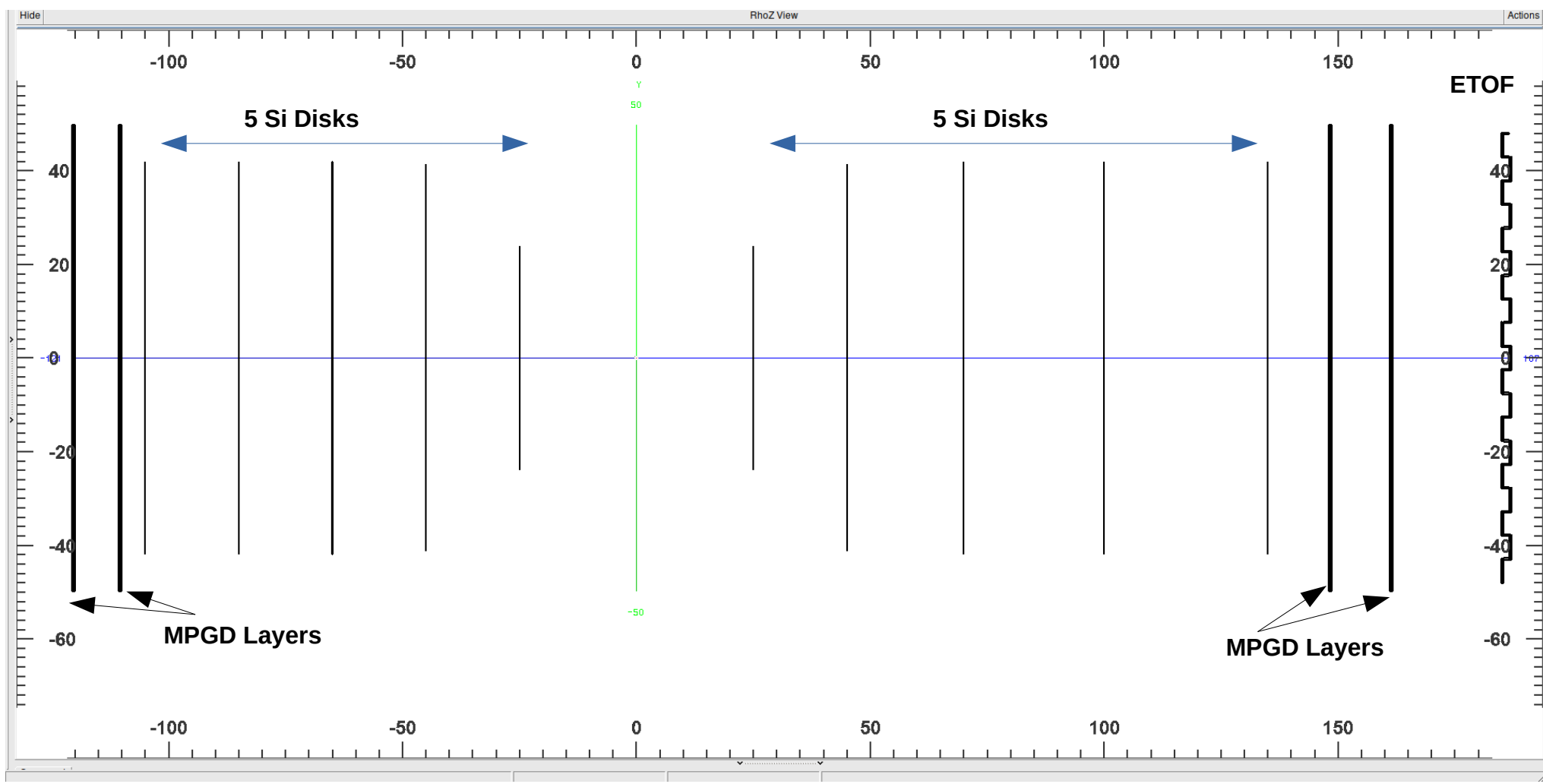
$$\qquad \qquad \qquad p_y = p_T \sin\phi$$

Track parameters branch can be used to evaluate tracking performances

Important to fit track outward-->inward for DCA_{xy} and DCA_z

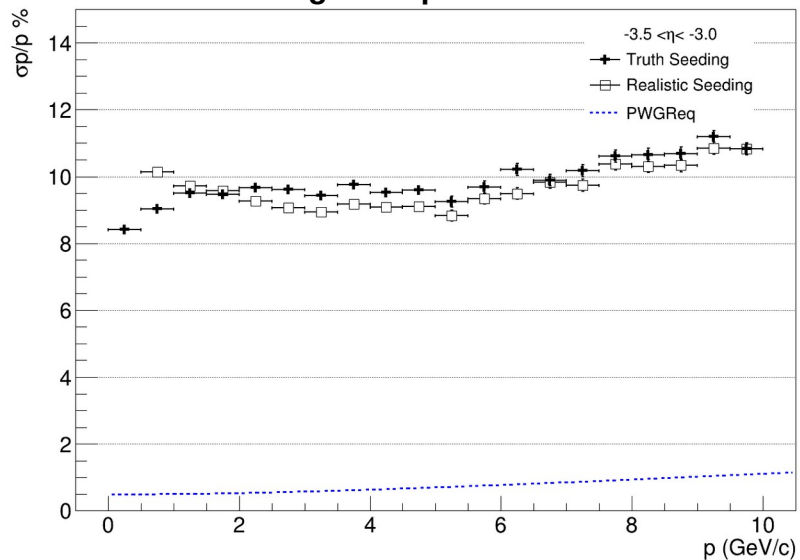
ePIC [Forward/Backward tracker]

Larger Lever arm at forward compared to the backward



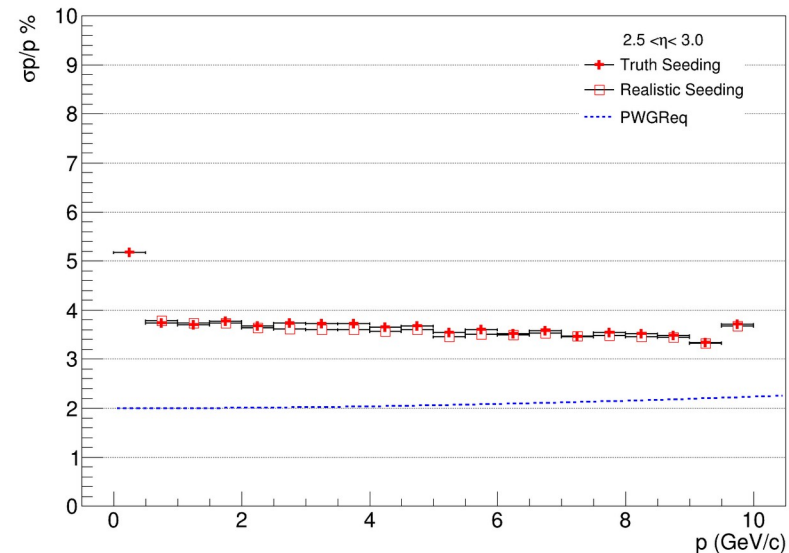
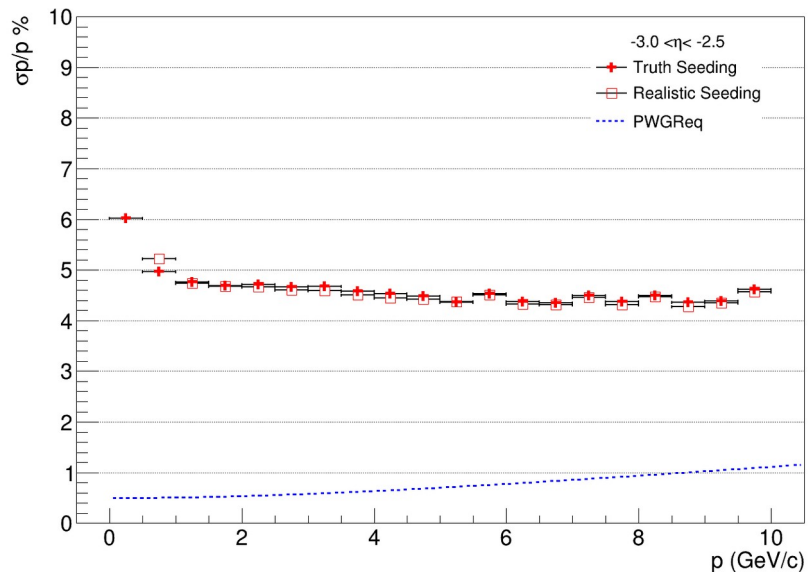
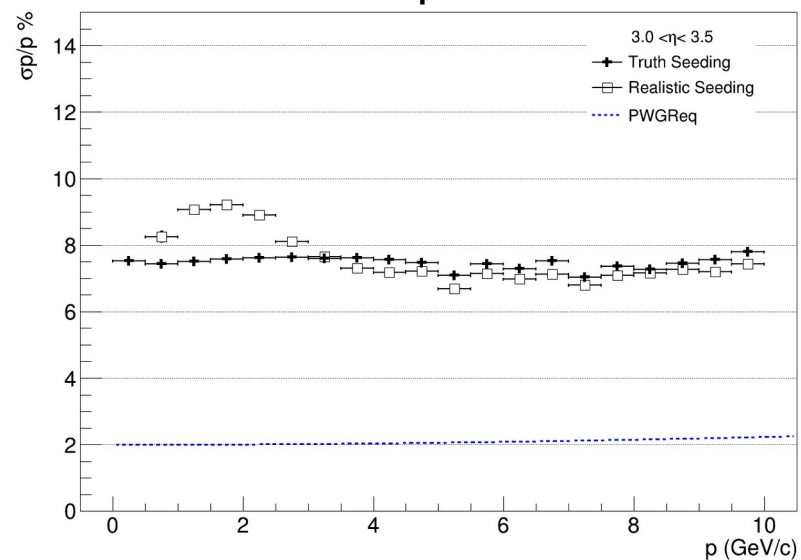
Tracking Performances

Negative η



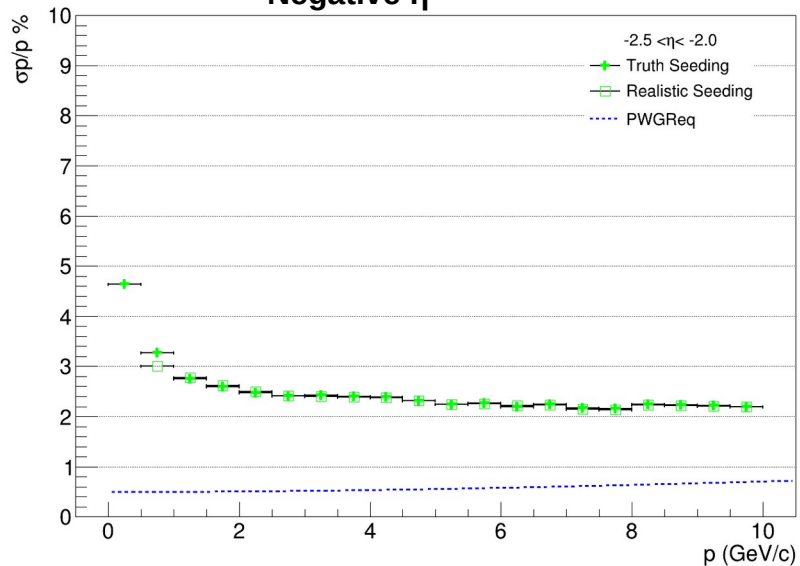
Large lever arm at +ve η

Positive η

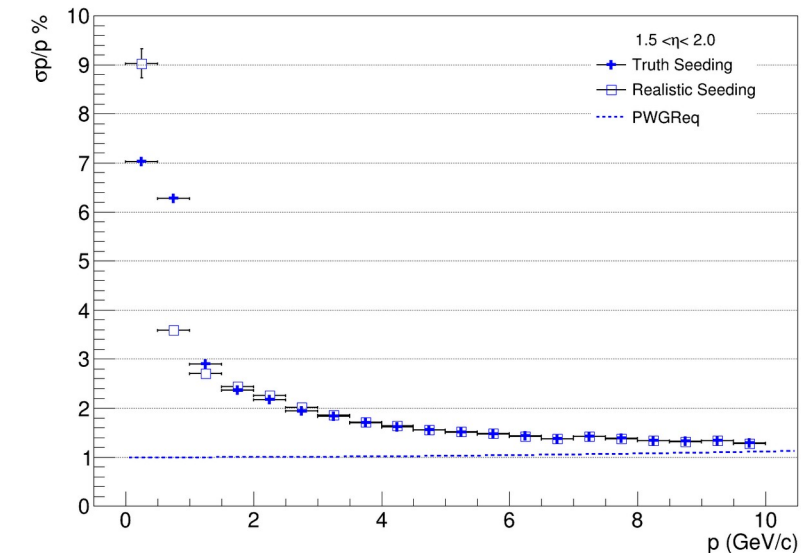
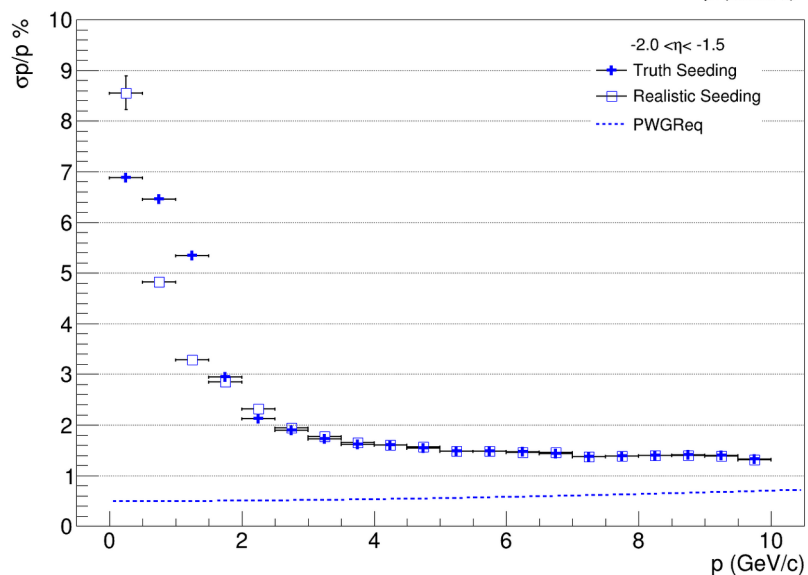
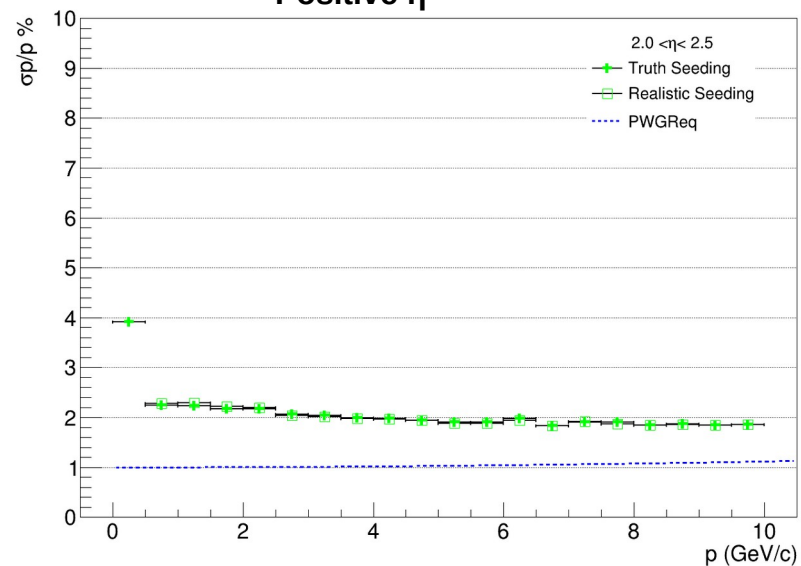


Tracking Performances

Negative η

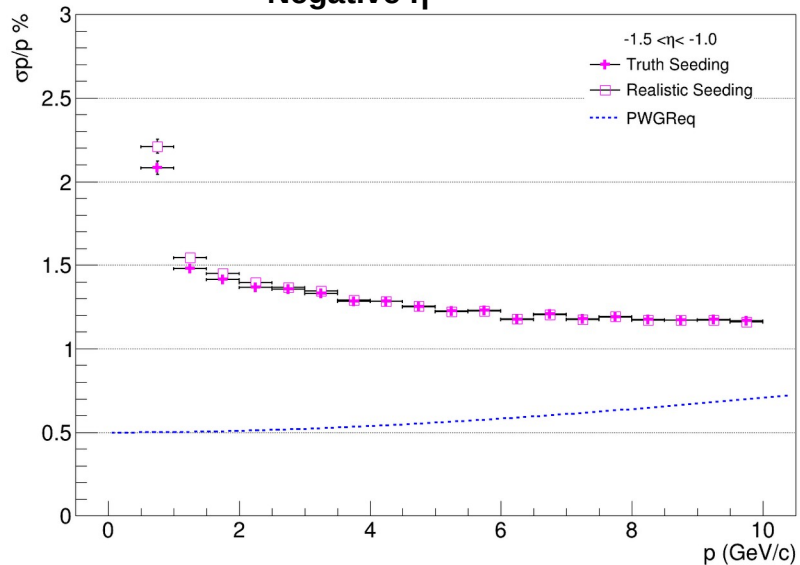


Positive η

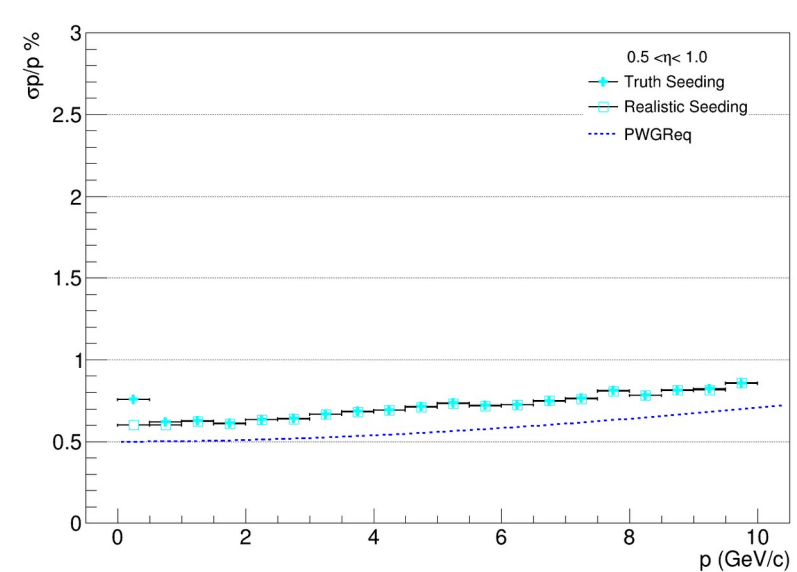
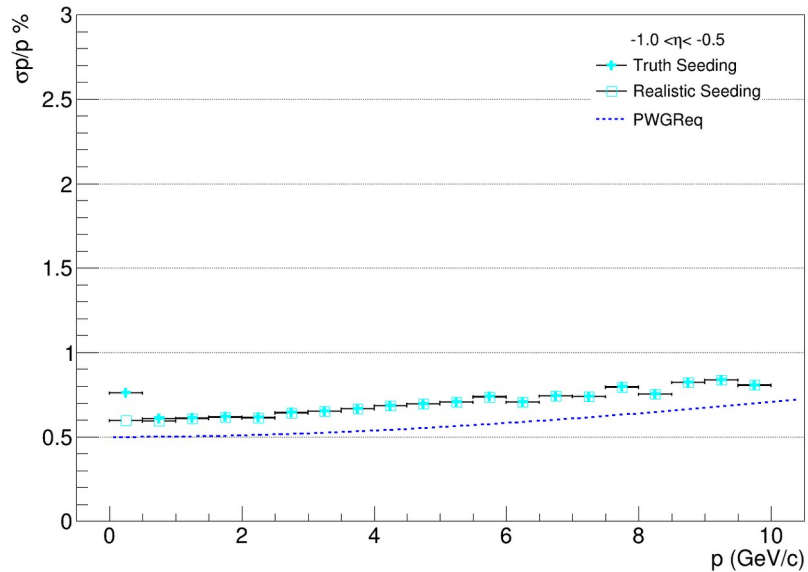
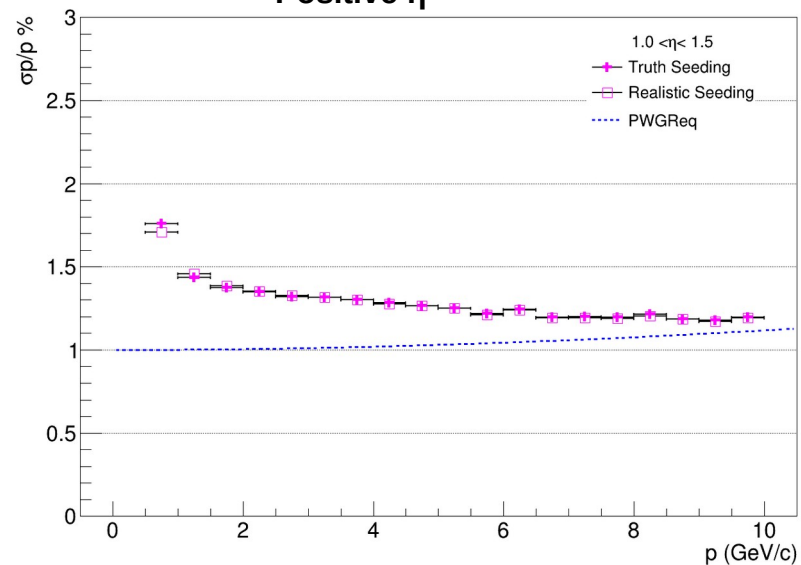


Tracking Performances

Negative η

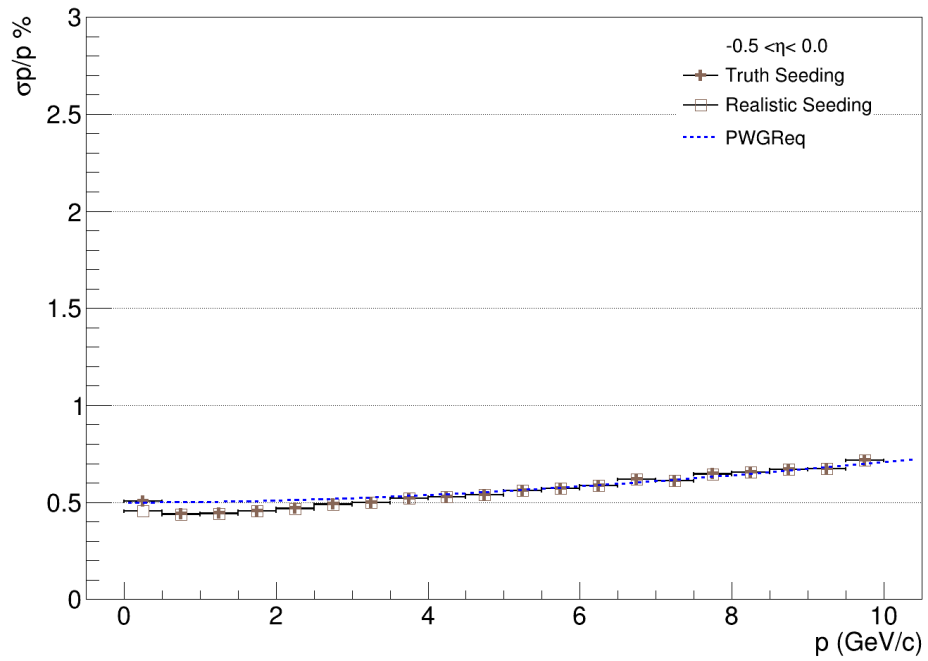


Positive η

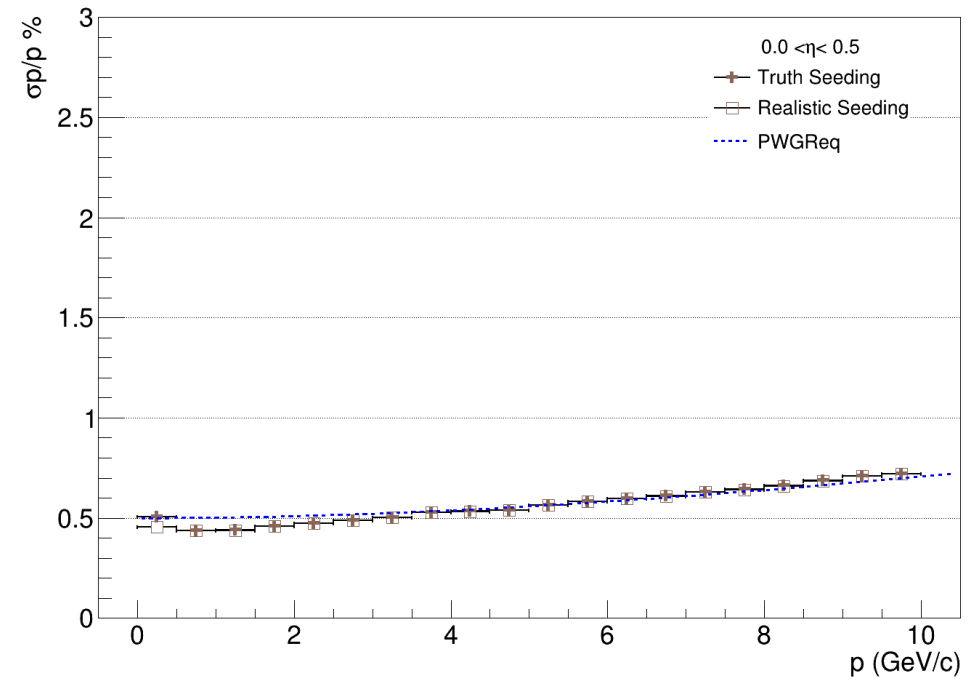


Tracking Performances

Negative η

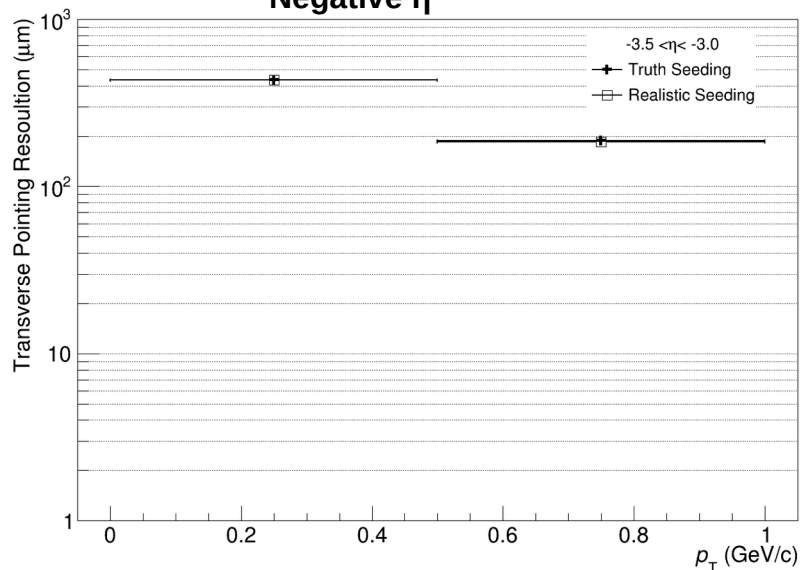


Positive η

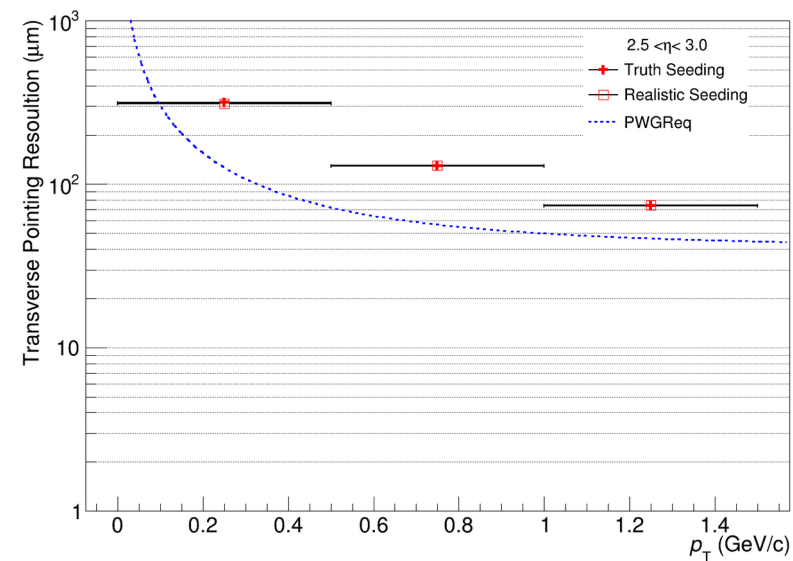
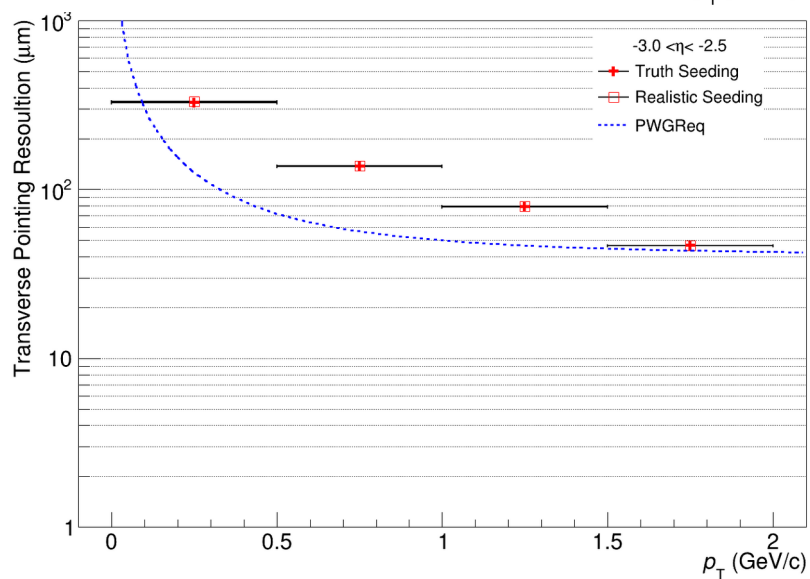
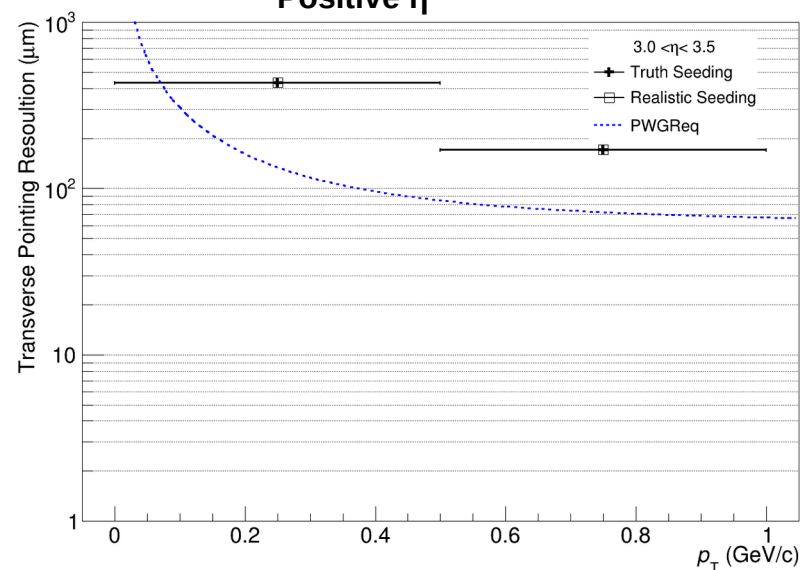


Tracking Performances

Negative η

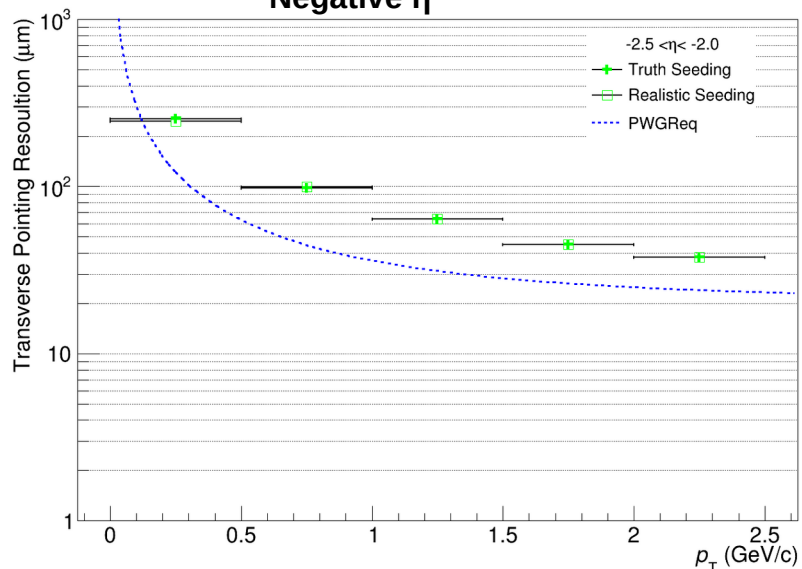


Positive η

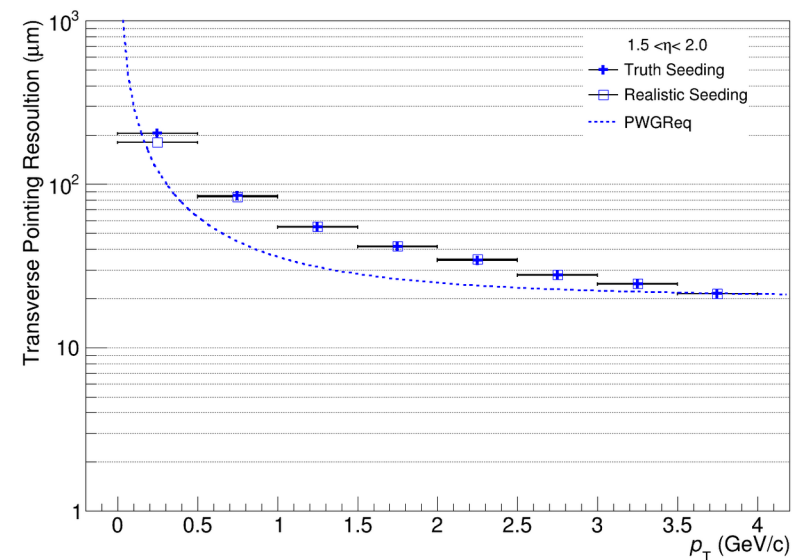
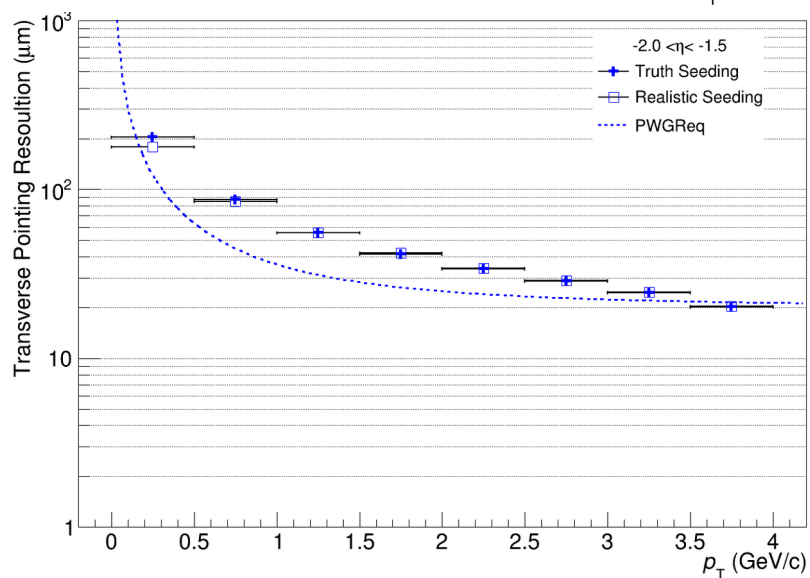
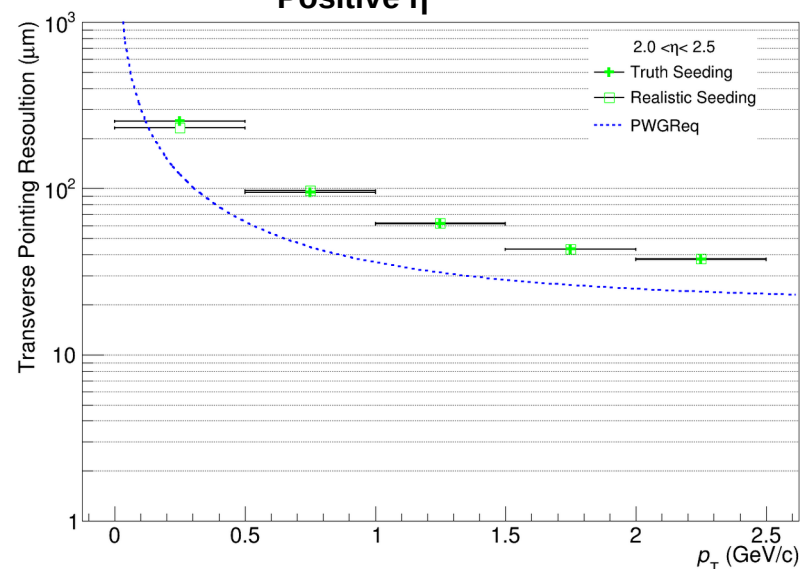


Tracking Performances

Negative η

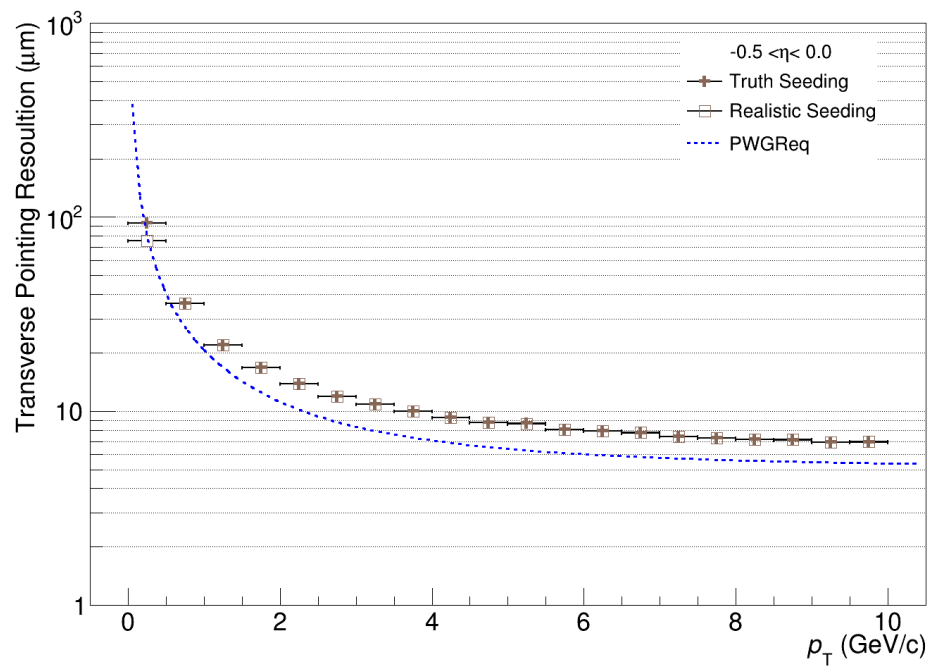


Positive η

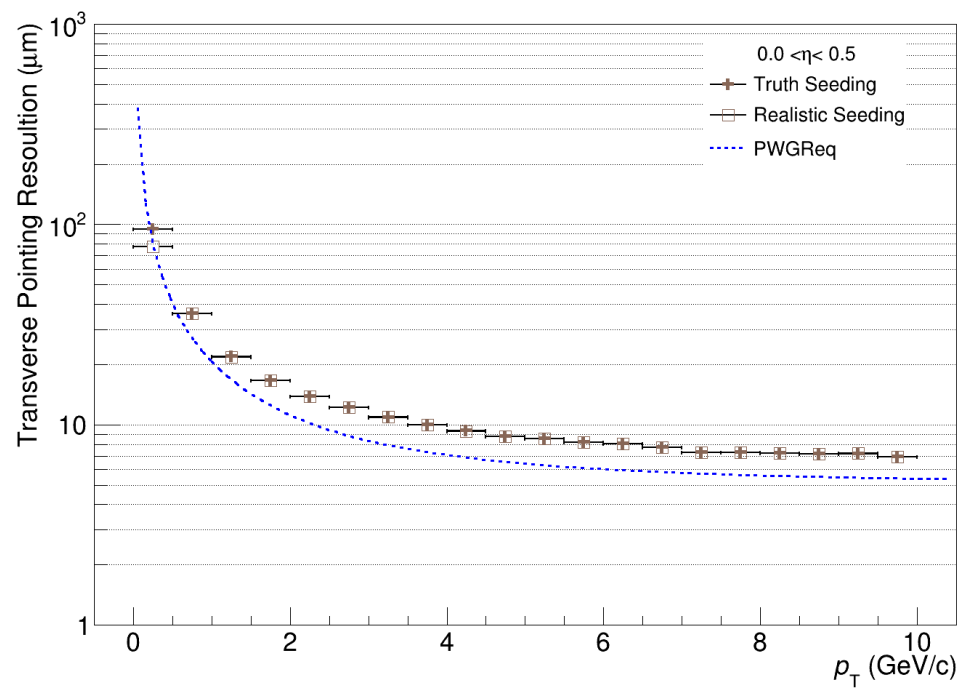


Tracking Performances

Negative η



Positive η



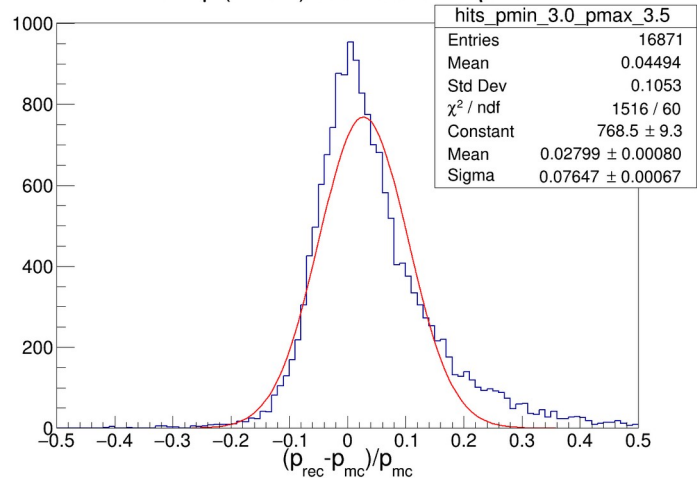
Summary

- Extracted the performances for momentum and transverse pointing resolutions using realistic and truth seeding
- Further trying to understand the strange intermediate distributions
- Will share the developed code to extract the tracking performances

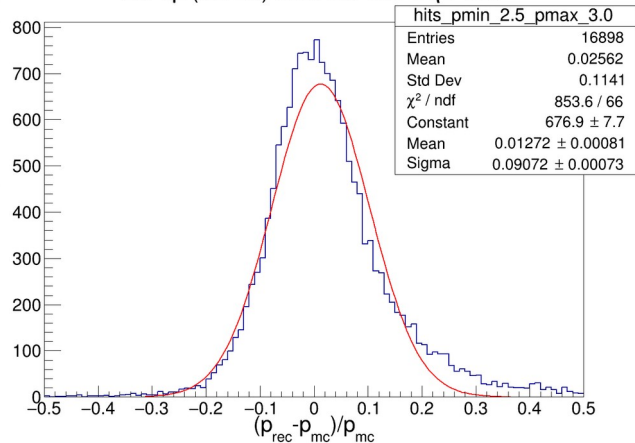
Realistic/Truth Seeding (Strange)

Realistic Seeding

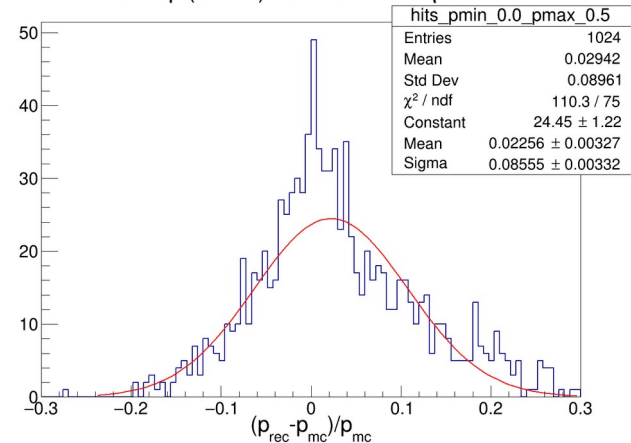
3.0 <p (GeV/c)< 3.5 && 3.0 < η < 3.5



2.5 <p (GeV/c)< 3.0 && -3.5 < η < -3.0

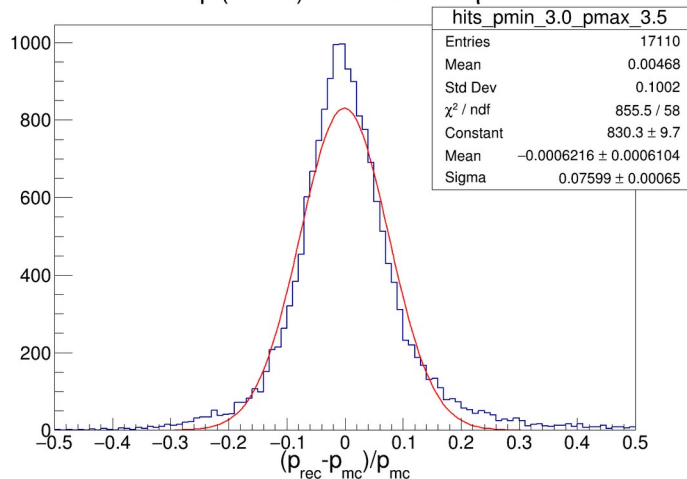


0.0 <p (GeV/c)< 0.5 && -2.0 < η < -1.5

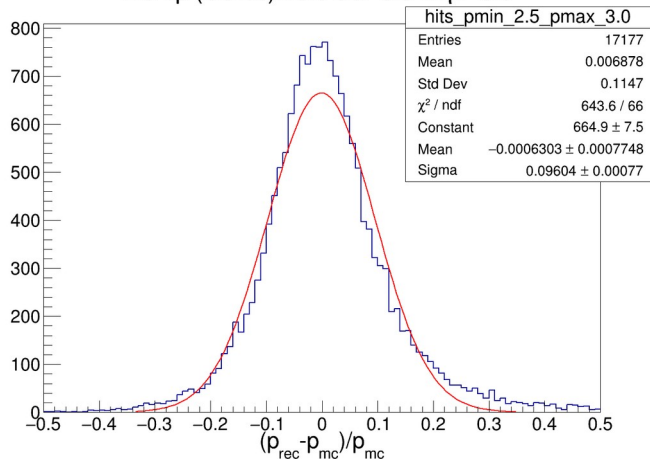


Truth Seeding

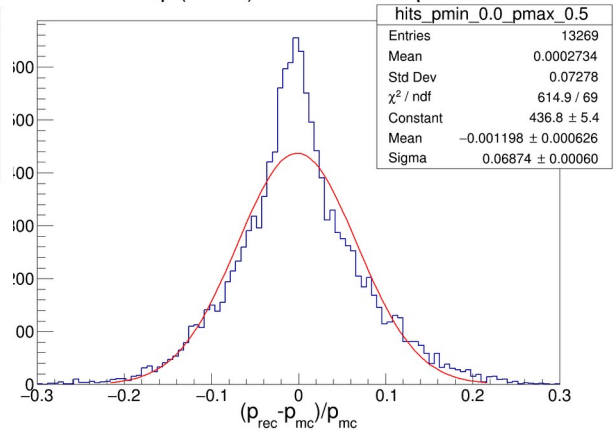
3.0 <p (GeV/c)< 3.5 && 3.0 < η < 3.5



2.5 <p (GeV/c)< 3.0 && -3.5 < η < -3.0

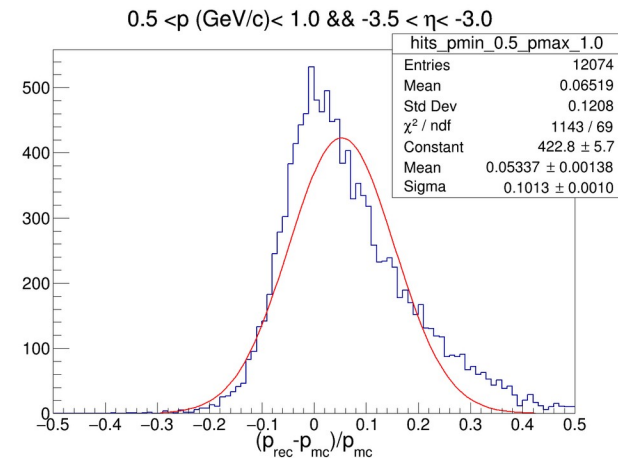
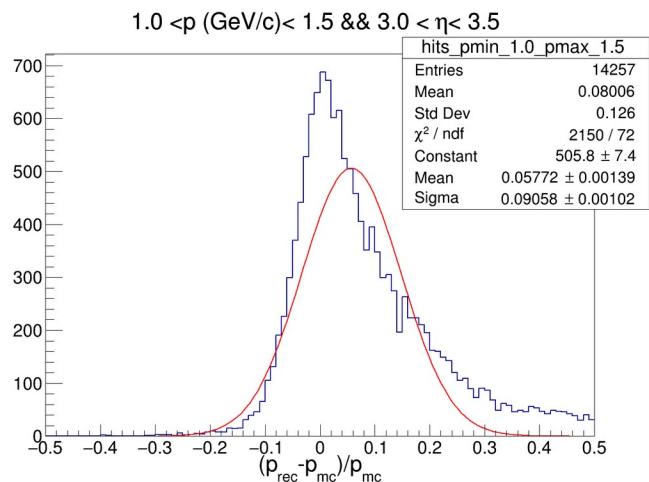
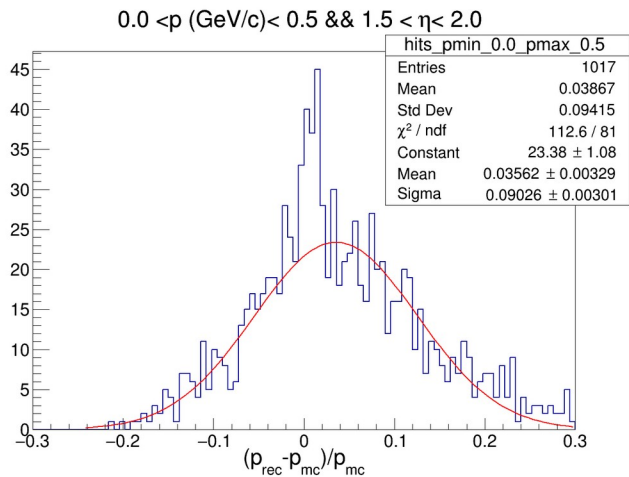


0.0 <p (GeV/c)< 0.5 && -2.0 < η < -1.5

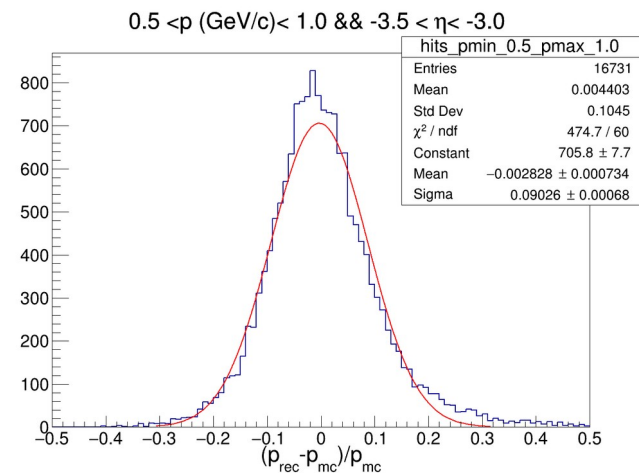
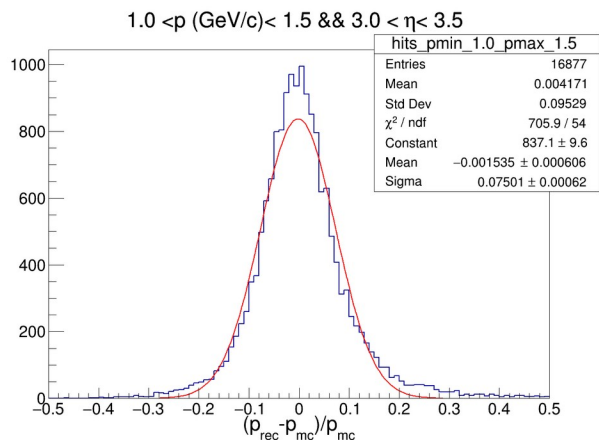
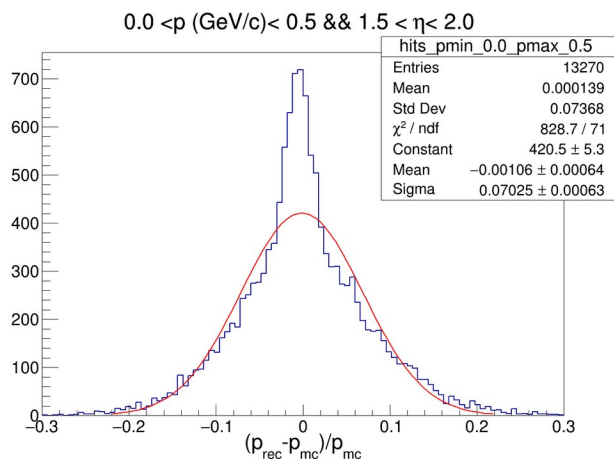


Realistic/Truth Seeding (Strange)

Realistic Seeding



Truth Seeding



ePIC Version

```
shyam@shyam:~/eic/epic$ git tag -l
22.10.0
22.10.1
22.10_rc1
22.11.0
22.11.1
22.11.2
22.11.3
22.12.0
23.01.0
23.03.0
23.05.0
23.05.1
23.05.2
23.06.0
23.06.1
23.07.0
23.07.1
23.07.2
23.08.0
23.09.0
23.09.1
23.10.0
23.11.0
23.12.0
24.02.0
24.02.1
shyam@shyam:~/eic/epic$
```

```
shyam@shyam:~/eic/EICrecon$ git tag -l
v0.1.0
v0.2.0
v0.2.1
v0.2.2
v0.2.3
v0.2.4
v0.2.5
v0.2.6
v0.2.7
v0.2.8
v0.3.0
v0.3.1
v0.3.2
v0.3.3
v0.3.4
v0.3.5
v0.3.6
v0.3.6.1
v0.3.6.2
v0.3.7
v0.4.0
v0.4.1
v0.4.2
v0.5.0
v0.5.1
v0.5.2
v0.5.3
v0.5.4
v0.6.0
v0.6.1
v0.6.2
v0.6.3
v0.6.4
v1.0.0
v1.1.0
v1.1.1
v1.10.0
v1.2.0
v1.2.1
v1.3.0
shyam@shyam:~/eic/EICrecon$
```

[epic_craterlake_tracking_only](#)