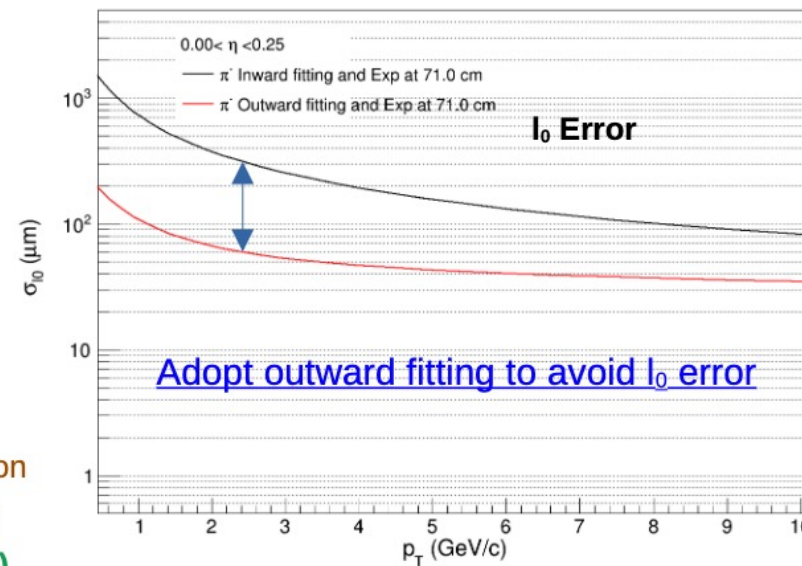
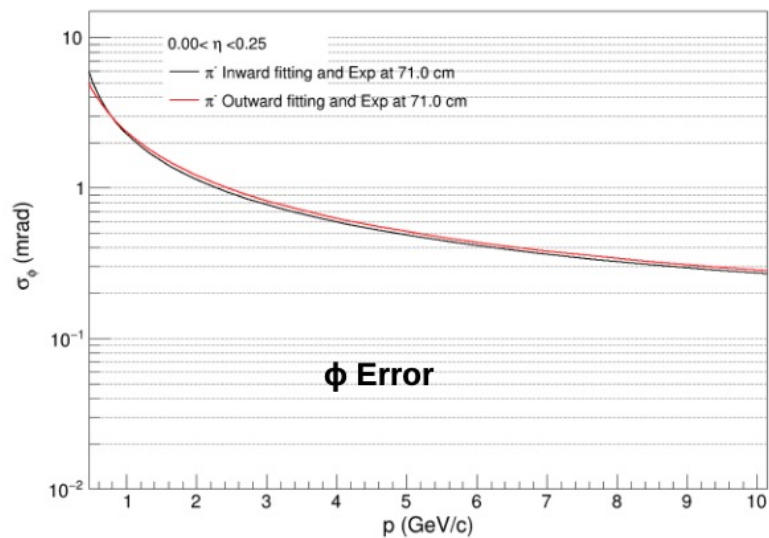
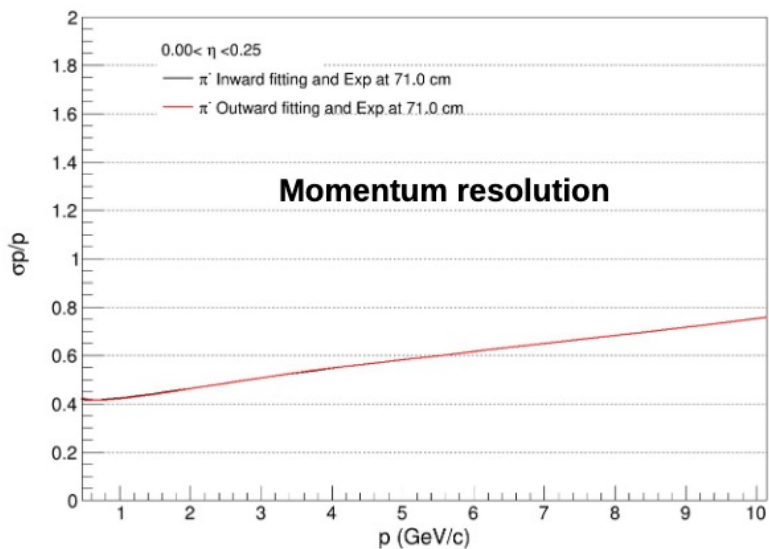


# MPGD Angular Resolution Study Update

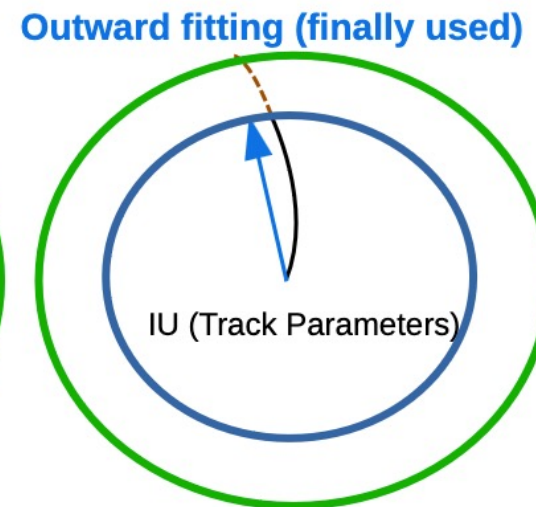
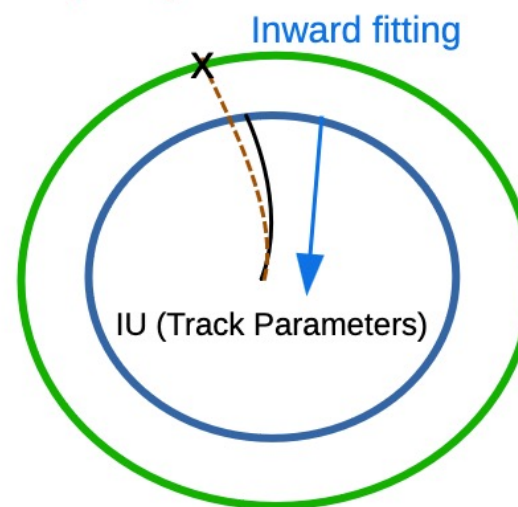
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Matt Posik  
Temple University

Shyam Kumar: [January ePIC Collaboration Meeting](#)



----- Extrapolation  
Outer MPGD  
DIRC (71 cm)

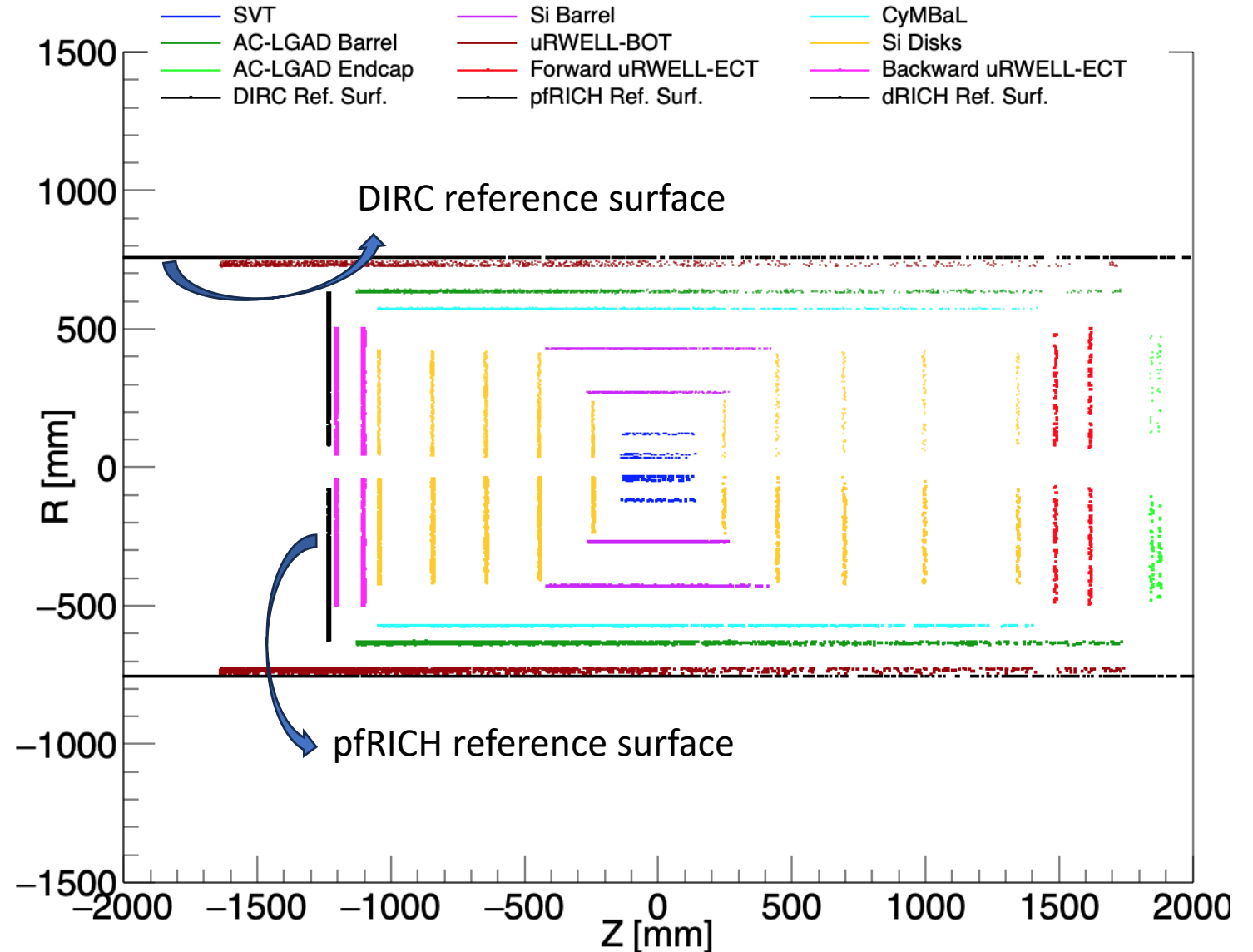


- ❑ Determine impact of MPGDs on resolutions at the PID surfaces: pFRICH, DIRC, dRICH and layers
  1. Resolution:  $50 \mu\text{m}$ ,  $150 \mu\text{m}$ ,  $1 \text{mm}$
  2. Impact of material
  3. KF fitting direction

This update looks at impact of MPGD resolutions on angular resolutions at pFRICH and DIRC detectors

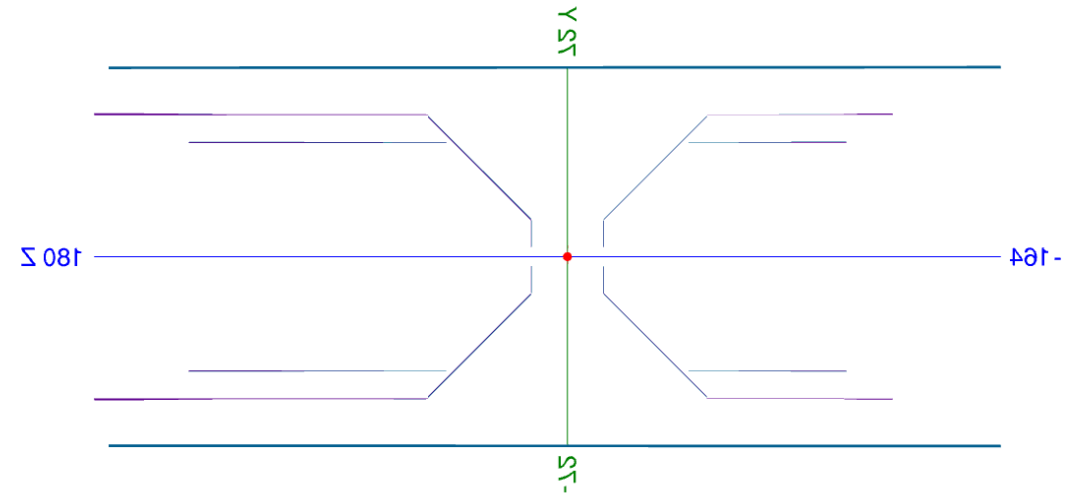
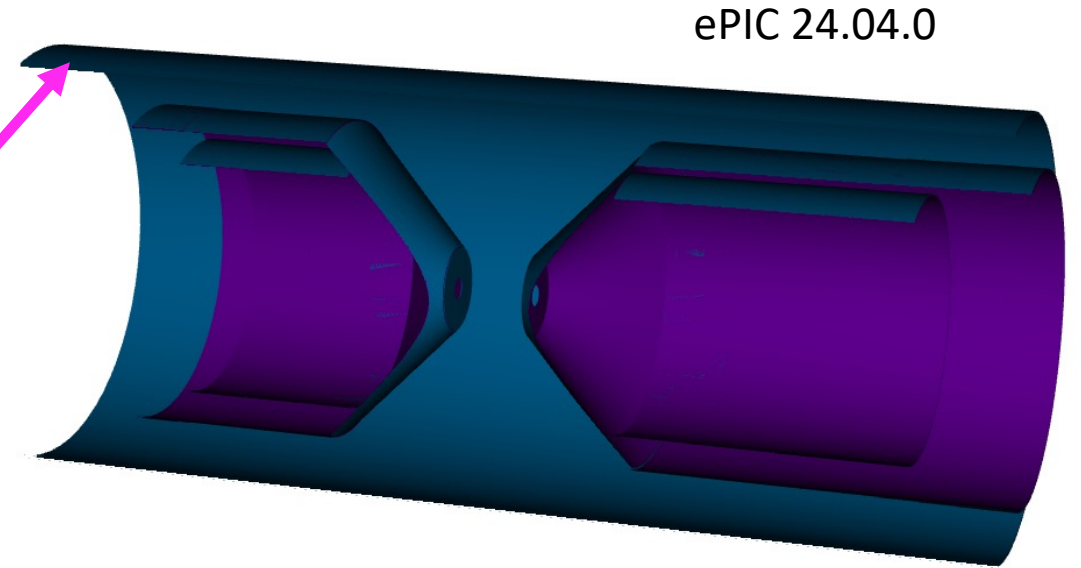
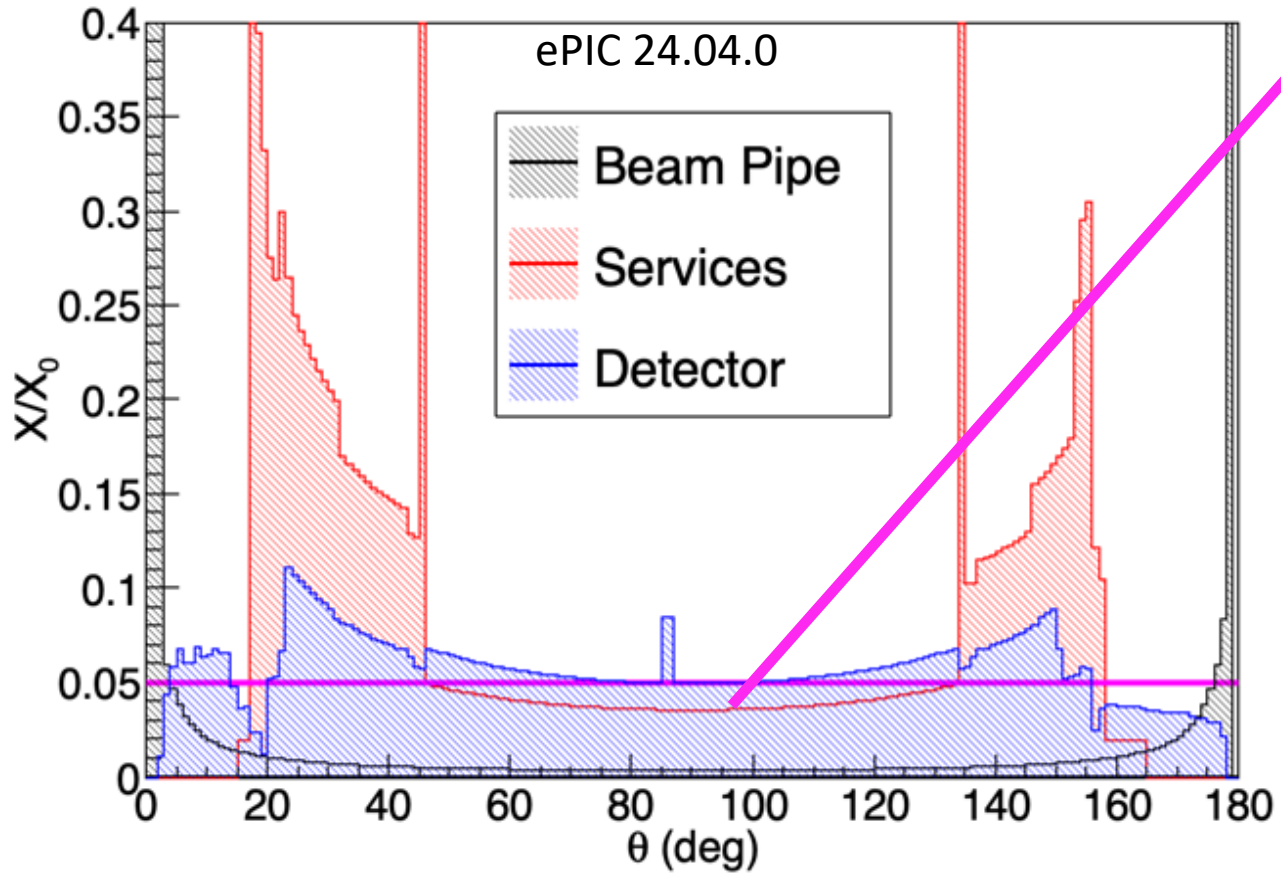
- Single particle:  $\pi^-$
- Uniform  $\phi$ :  $0^\circ < \phi < 360^\circ$
- Narrow  $\theta$  range:  $\Delta\theta = 2^\circ$
- Fixed discrete momentum values
- ePIC Version: 24.04.0
- EICrecon Version: v1.13.1

- DD4hep Disk Reference Surfaces:
  - pfRICH is disk at  $Z = -123.5$  cm
  - DIRC is cylinder at  $R = 75.5$  cm
  - Low mass  $X/X_0 \sim 0.01\%$
  - Outside tracking volume
  - Used to register hit to compare propagated reconstructed track to
- Angular resolutions assessed via difference between **track propagated** to ACTS reference surface location and **closest hit** on dd4hep reference surface



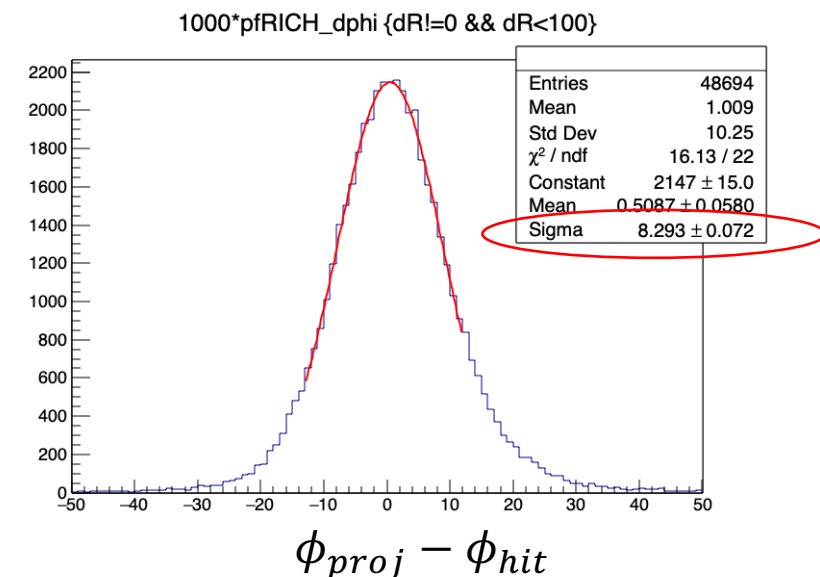
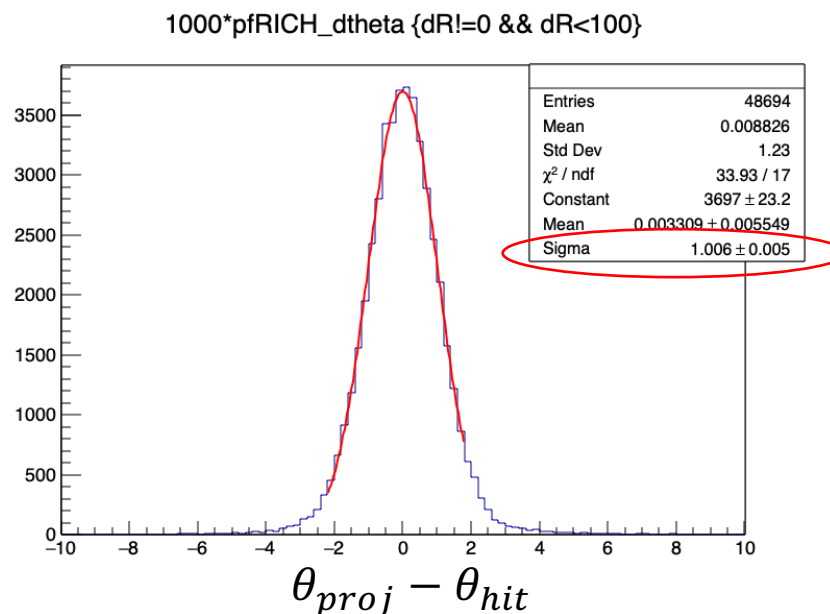
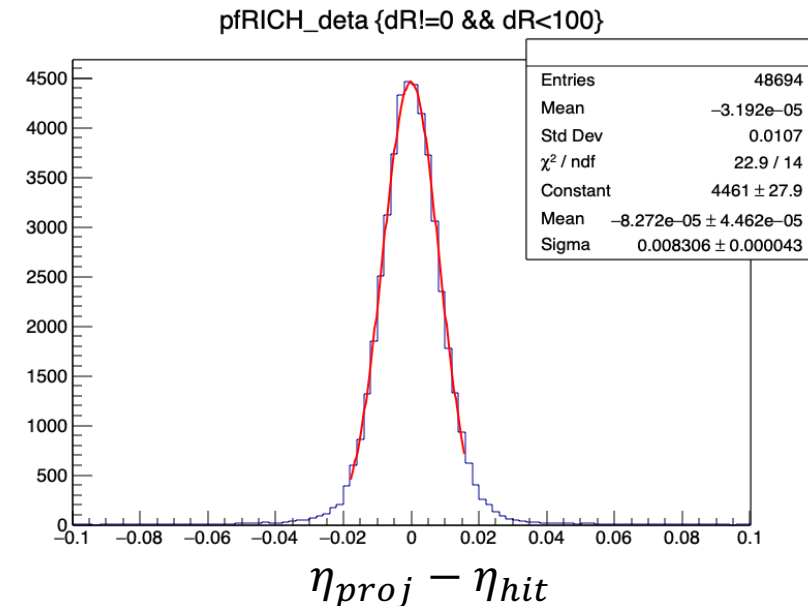
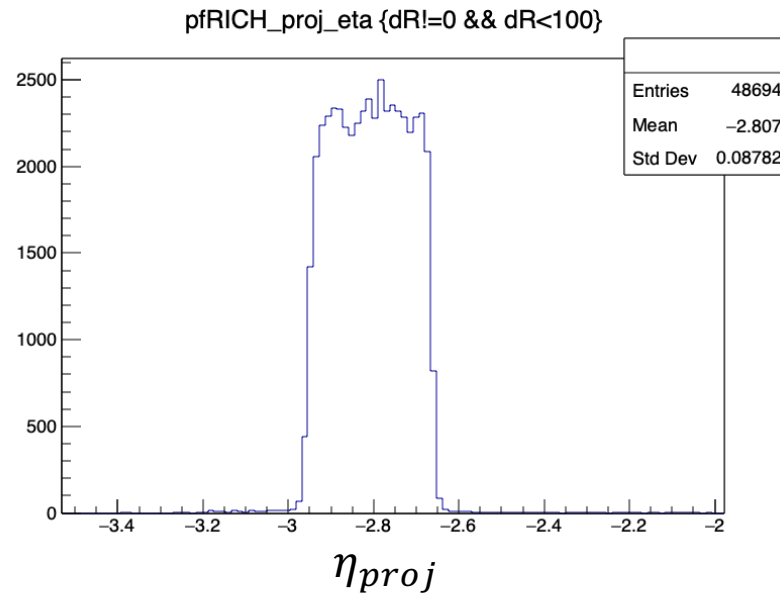
Support located before track enters uRWELL-BOT layer

[TIC \(3/10/24\)](#)



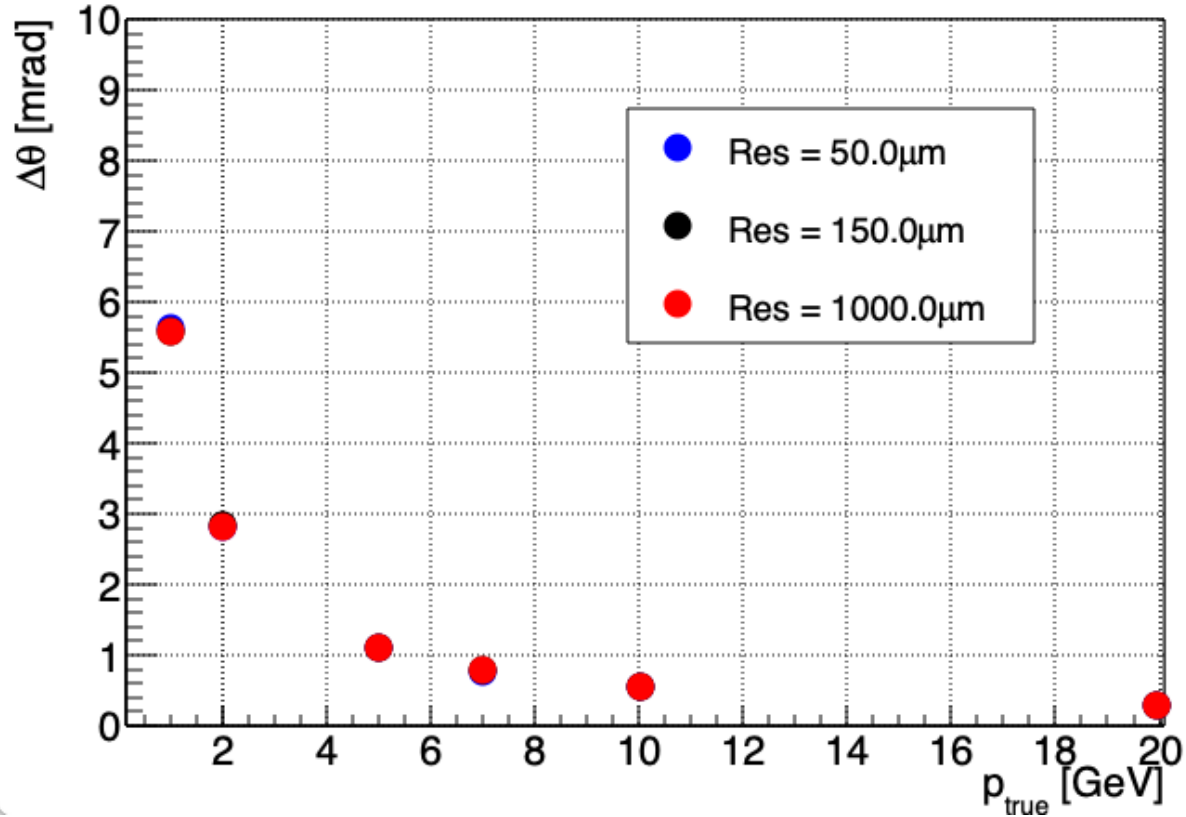
## Representative pfRICH example

- $p = 2 \text{ GeV}$
- $172^\circ < \theta < 174^\circ$
- $\Delta\eta \sim 0.01$
- $\Delta\theta \sim 1.0 \text{ mrad}$
- $\Delta\phi \sim 8.3 \text{ mrad}$

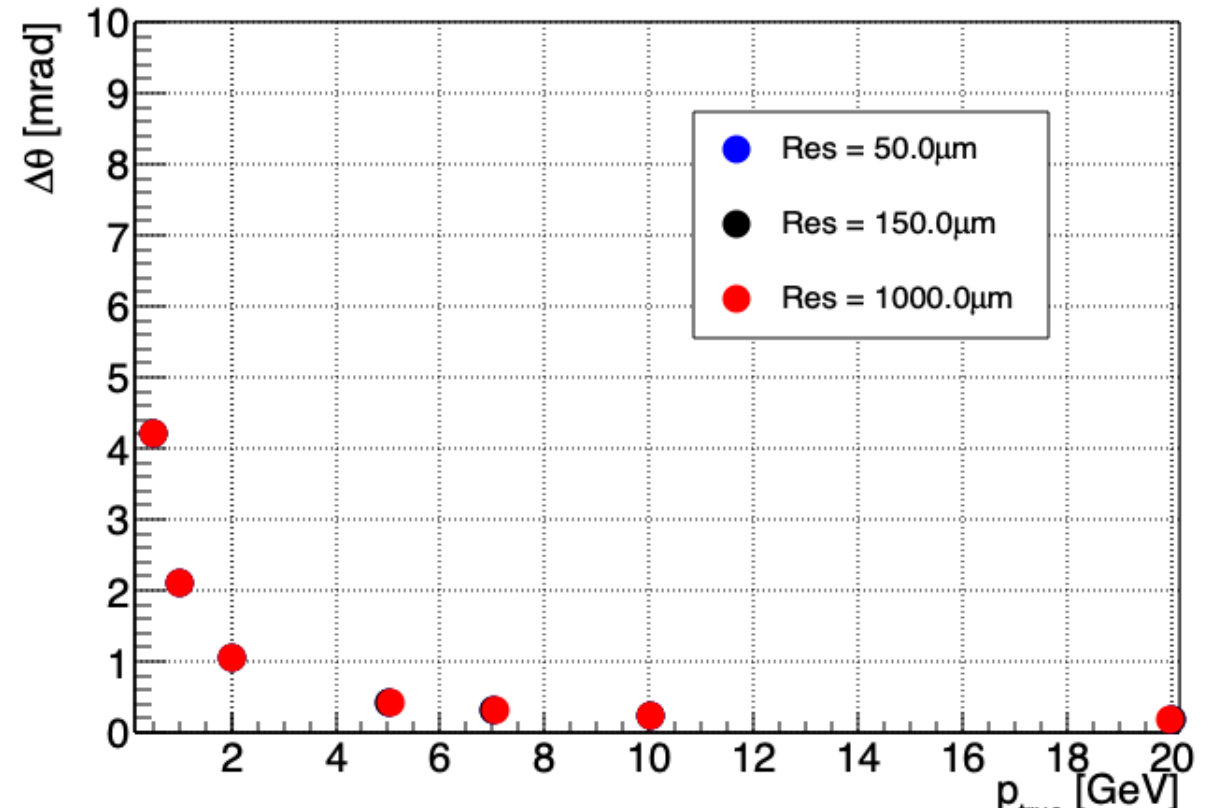


□ Single particle:  $\pi^-$

152 <math>\theta</math> <math><\eta> = -1.43</math>



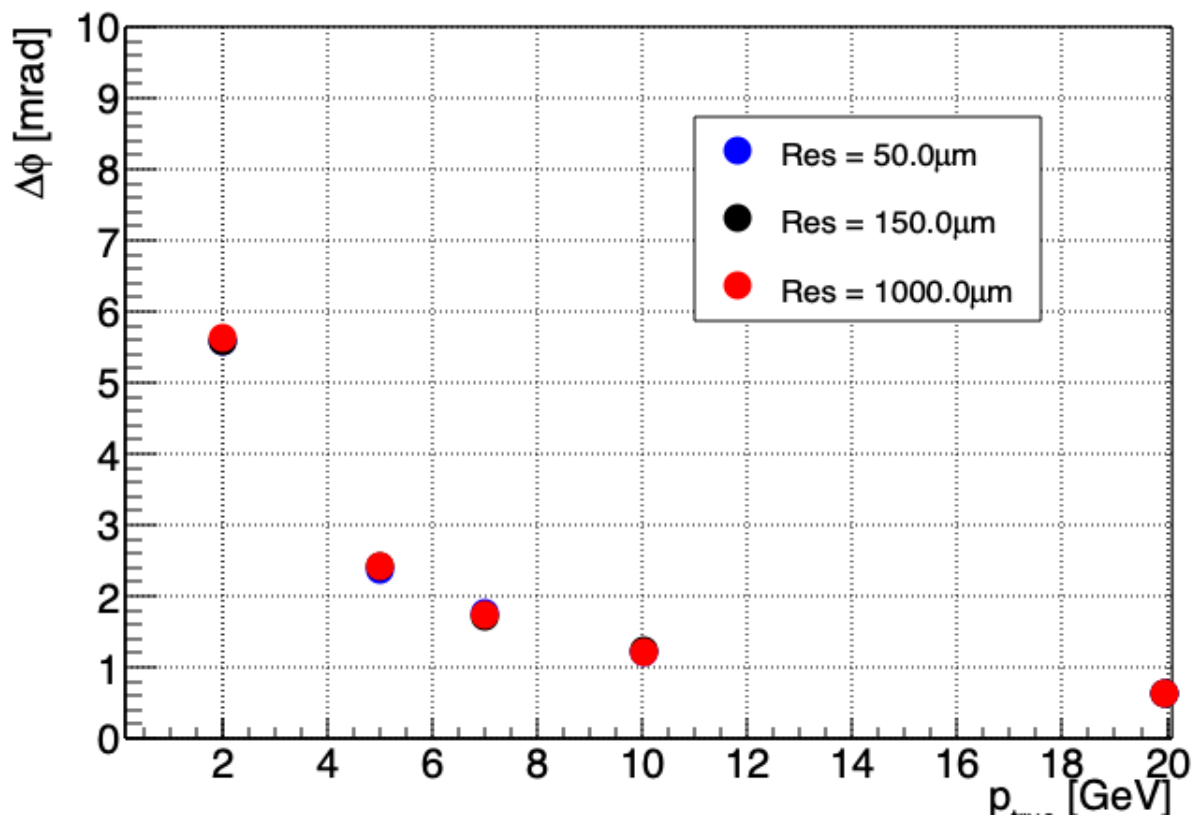
172 <math>\theta</math> <math><\eta> = -2.80</math>



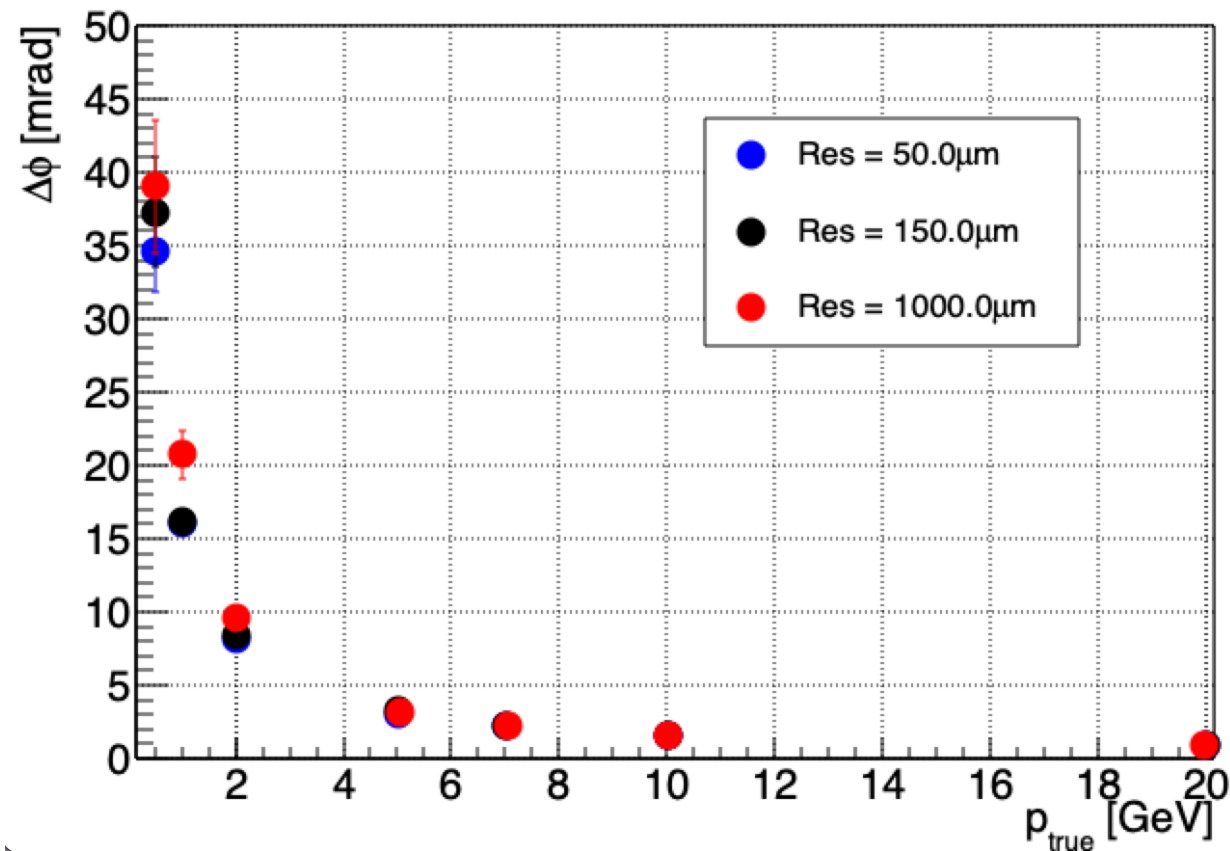


□ Single particle:  $\pi^-$

152 <math>\theta</math> <math><\eta> = -1.43</math>

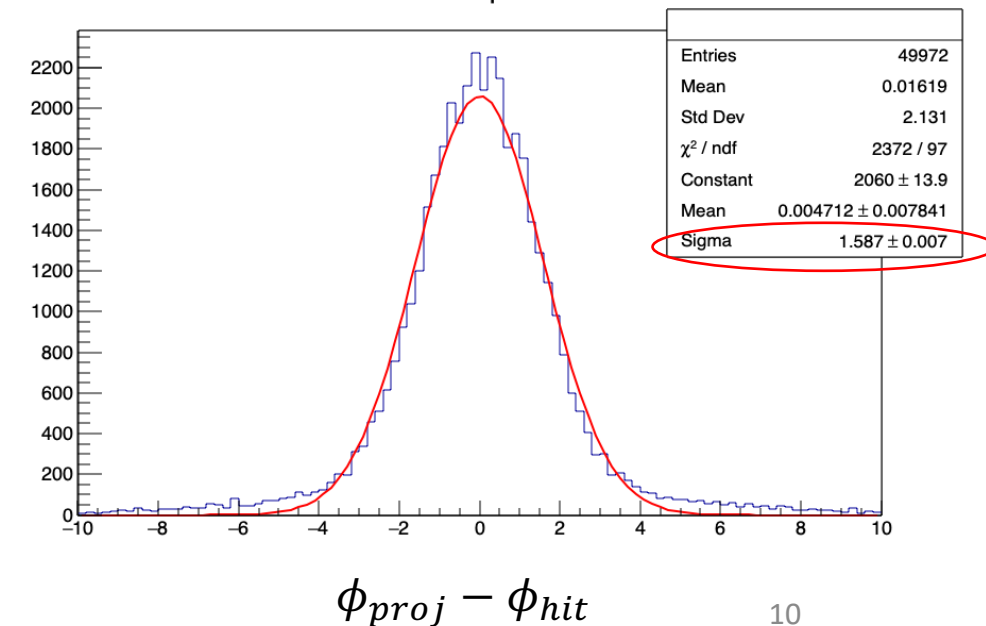
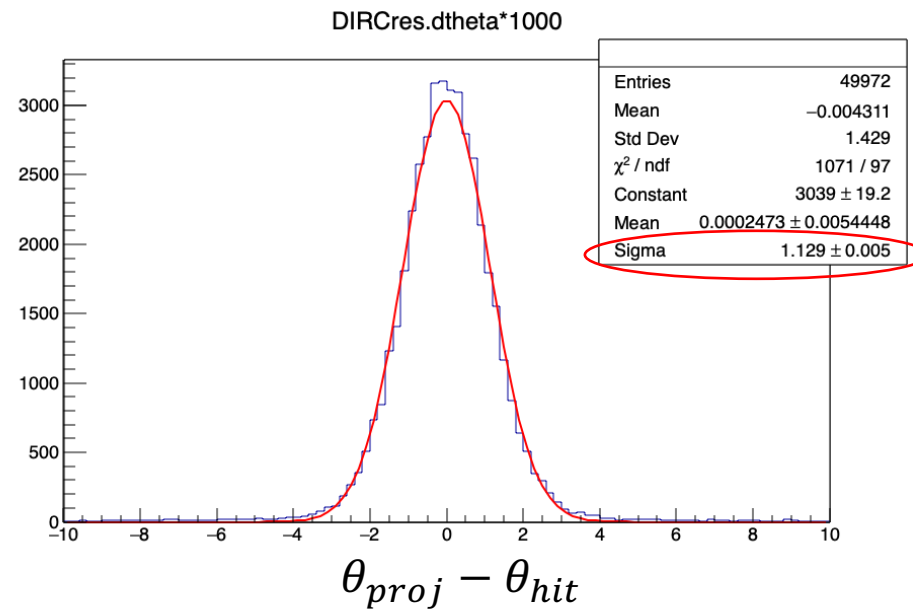
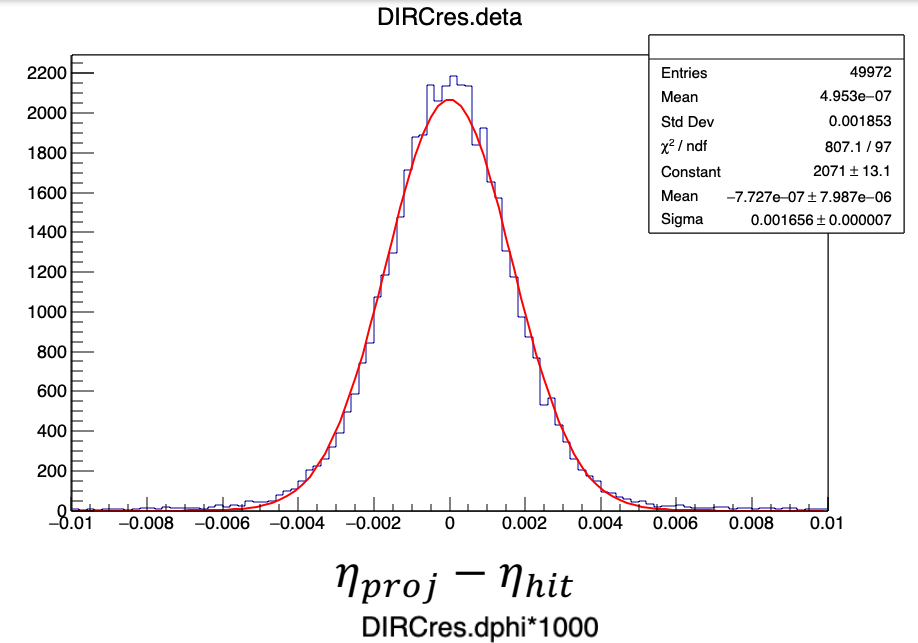
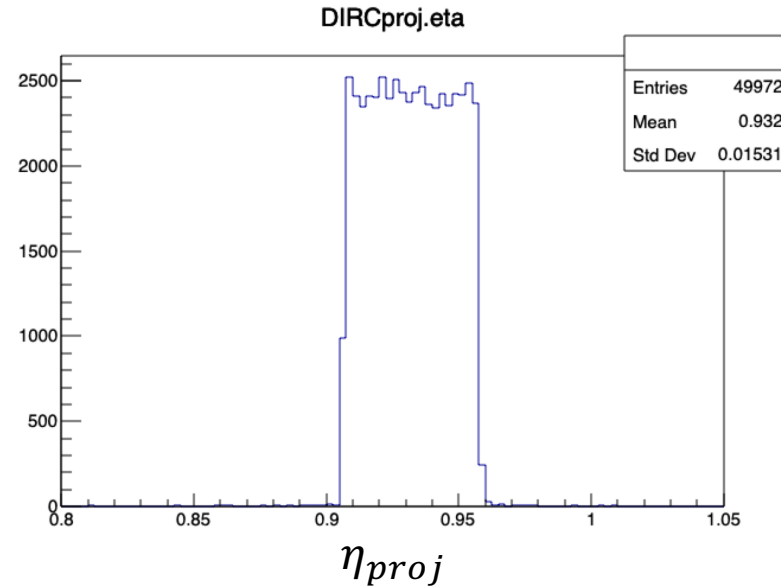


172 <math>\theta</math> <math><\eta> = -2.80</math>



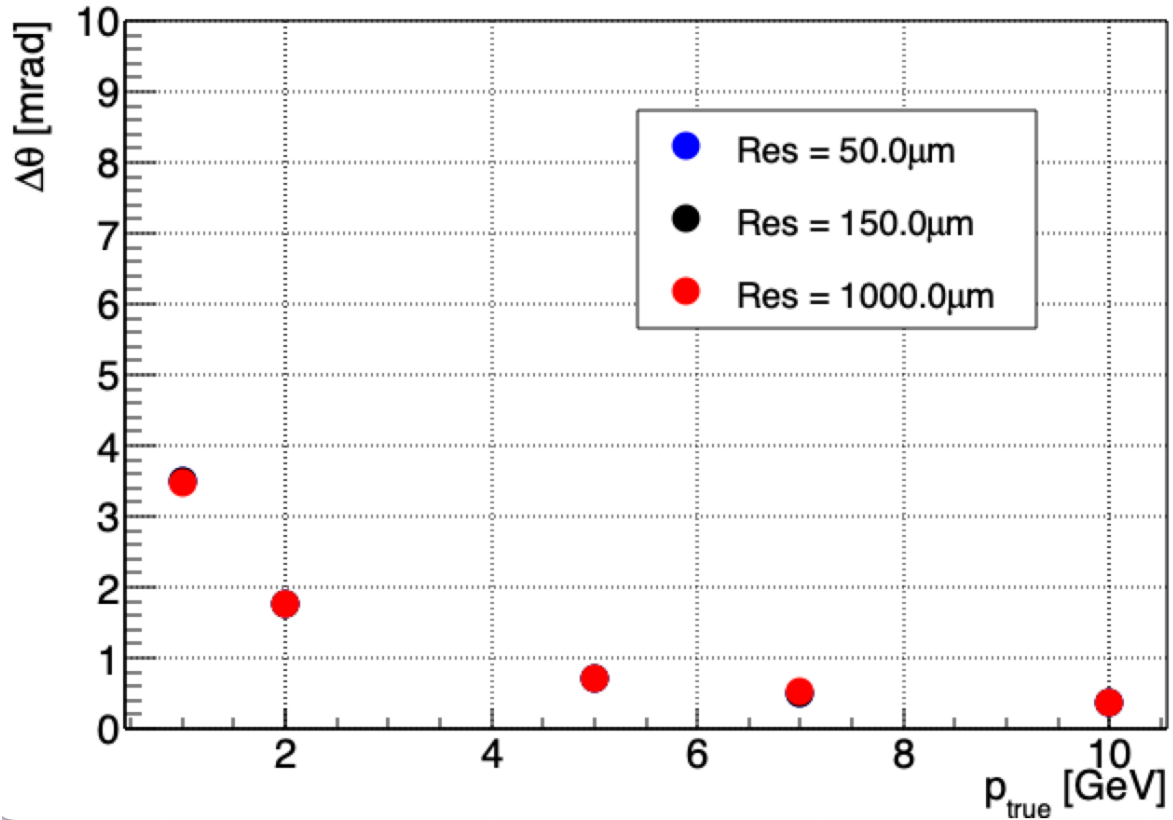
## Representative DIRC example

- $p = 5 \text{ GeV}$
- $42^\circ < \theta < 44^\circ$
- $\Delta\eta \sim 0.001$
- $\Delta\theta \sim 1.1 \text{ mrad}$
- $\Delta\phi \sim 1.6 \text{ mrad}$

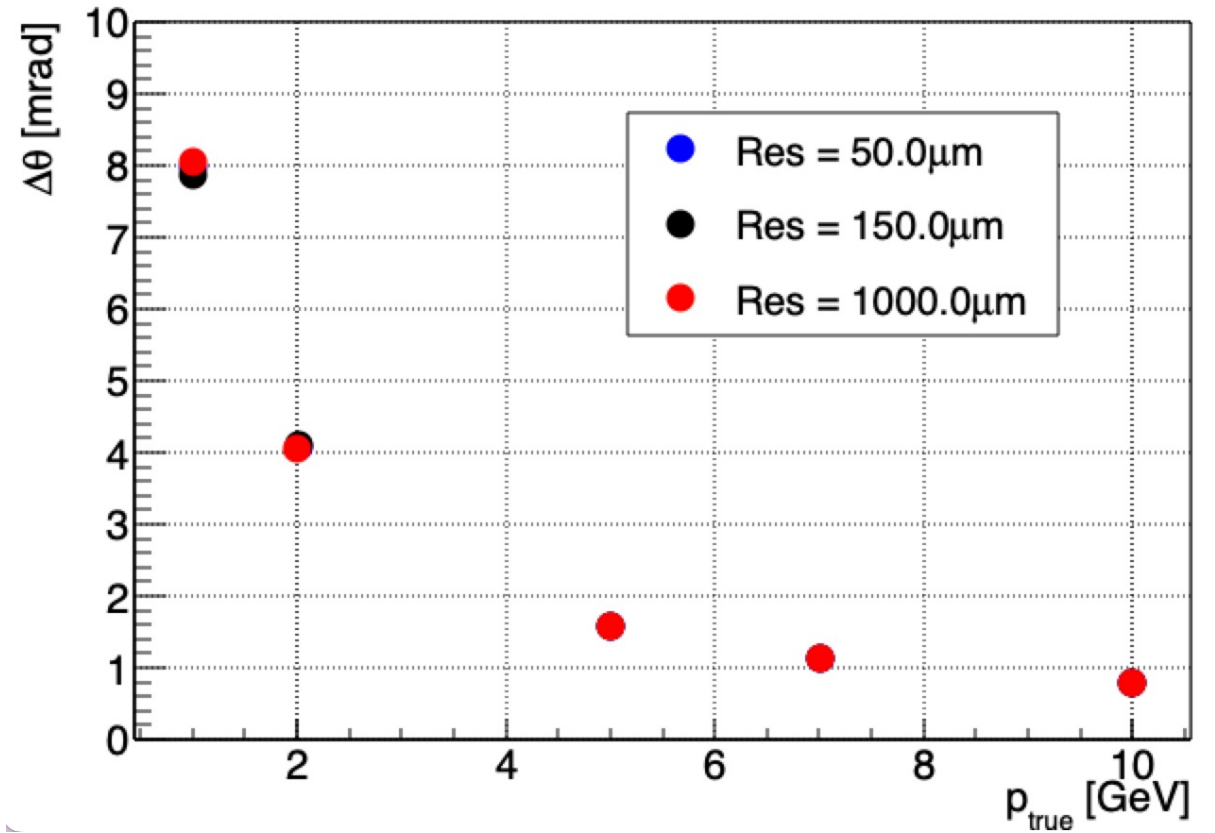


□ Single particle:  $\pi^-$

$92 < \theta < 94, \langle \eta \rangle = -0.05$

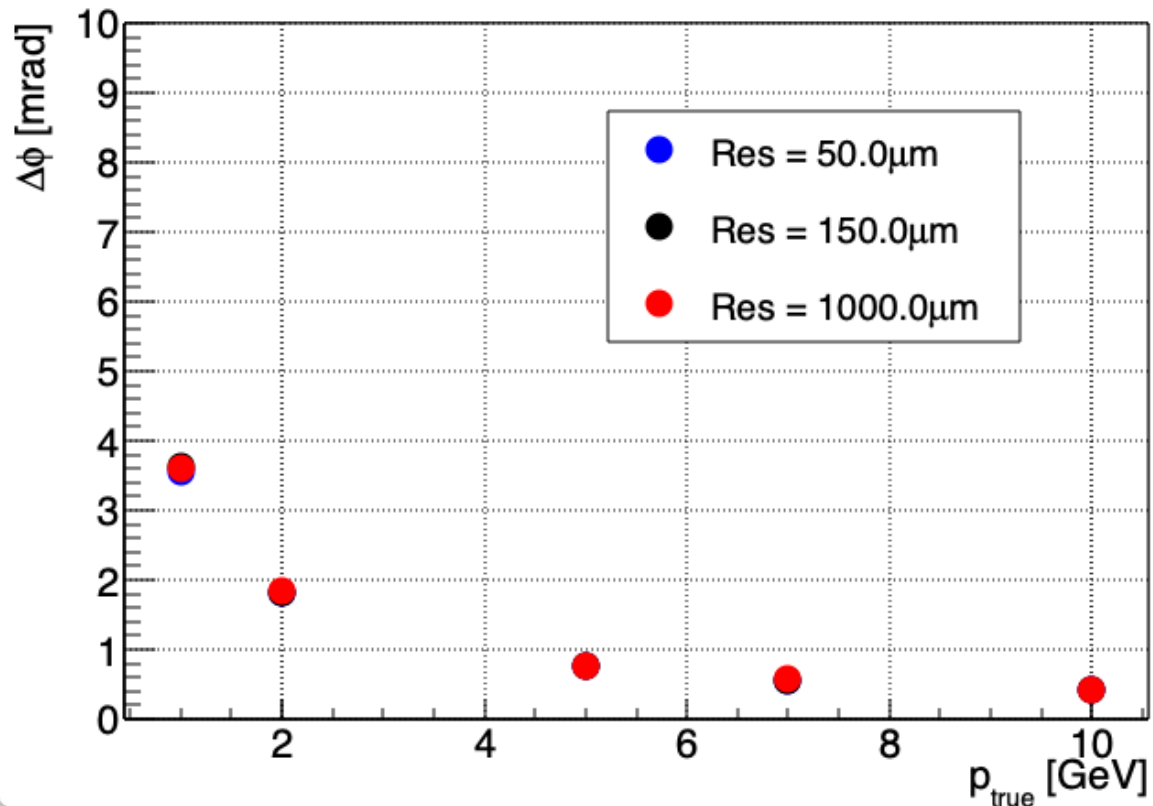


$22 < \theta < 24, \langle \eta \rangle = 1.59$

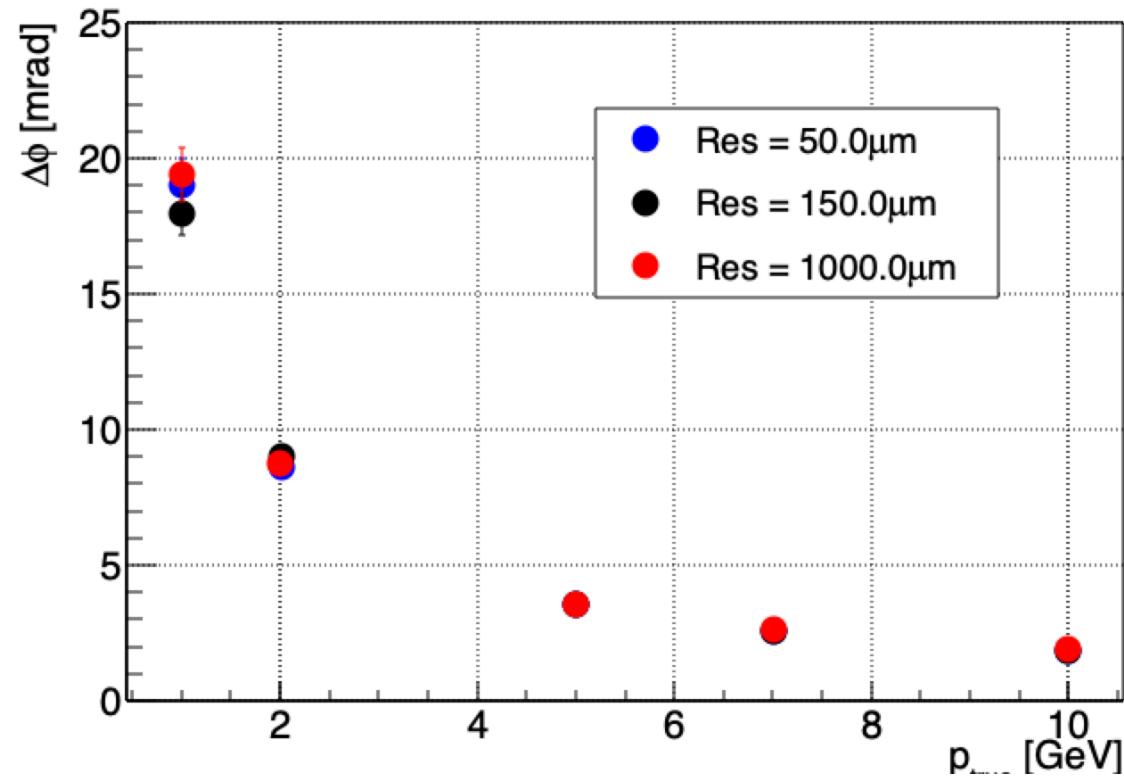


□ Single particle:  $\pi^-$

$92 < \theta < 94, \langle \eta \rangle = -0.05$

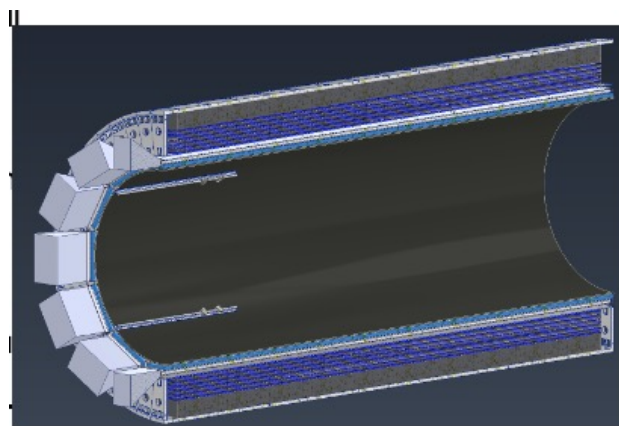
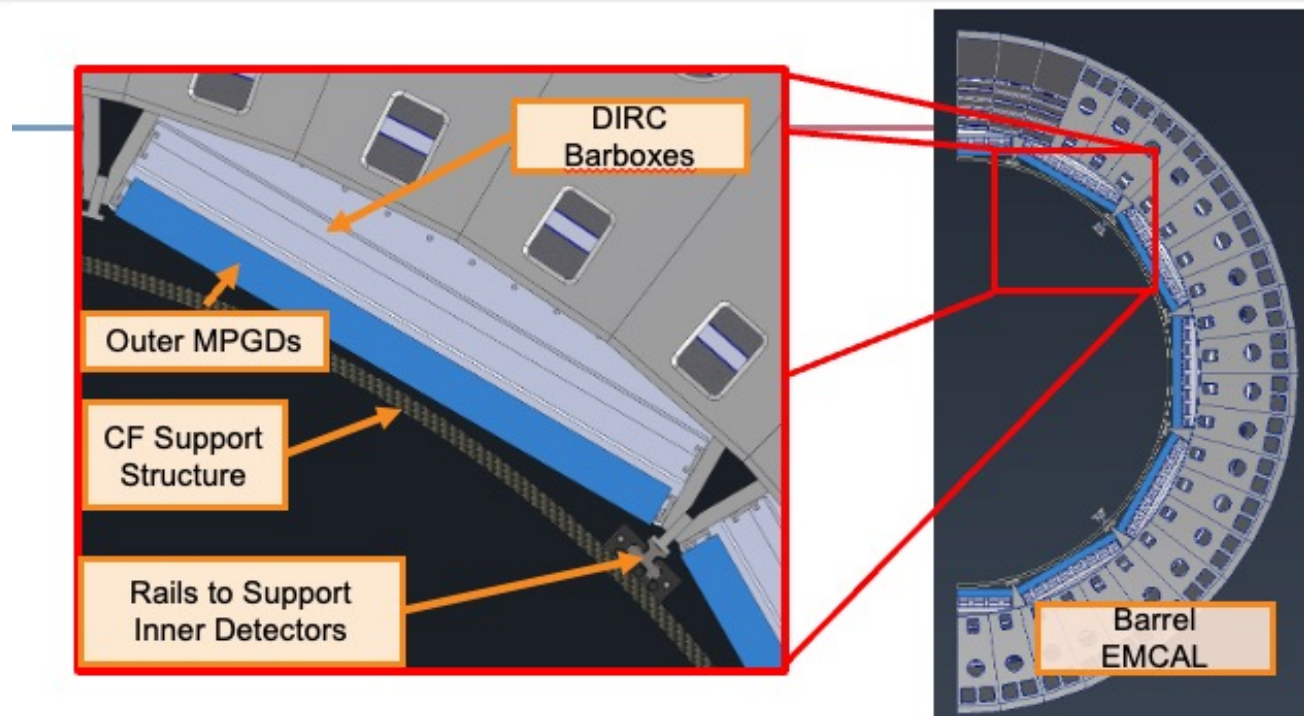


$22 < \theta < 24, \langle \eta \rangle = 1.59$

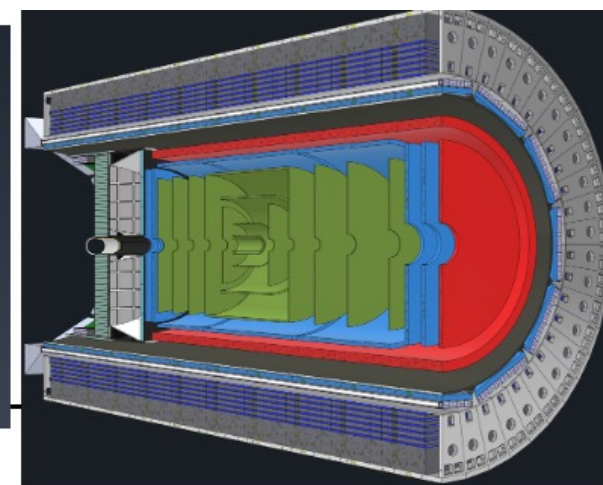




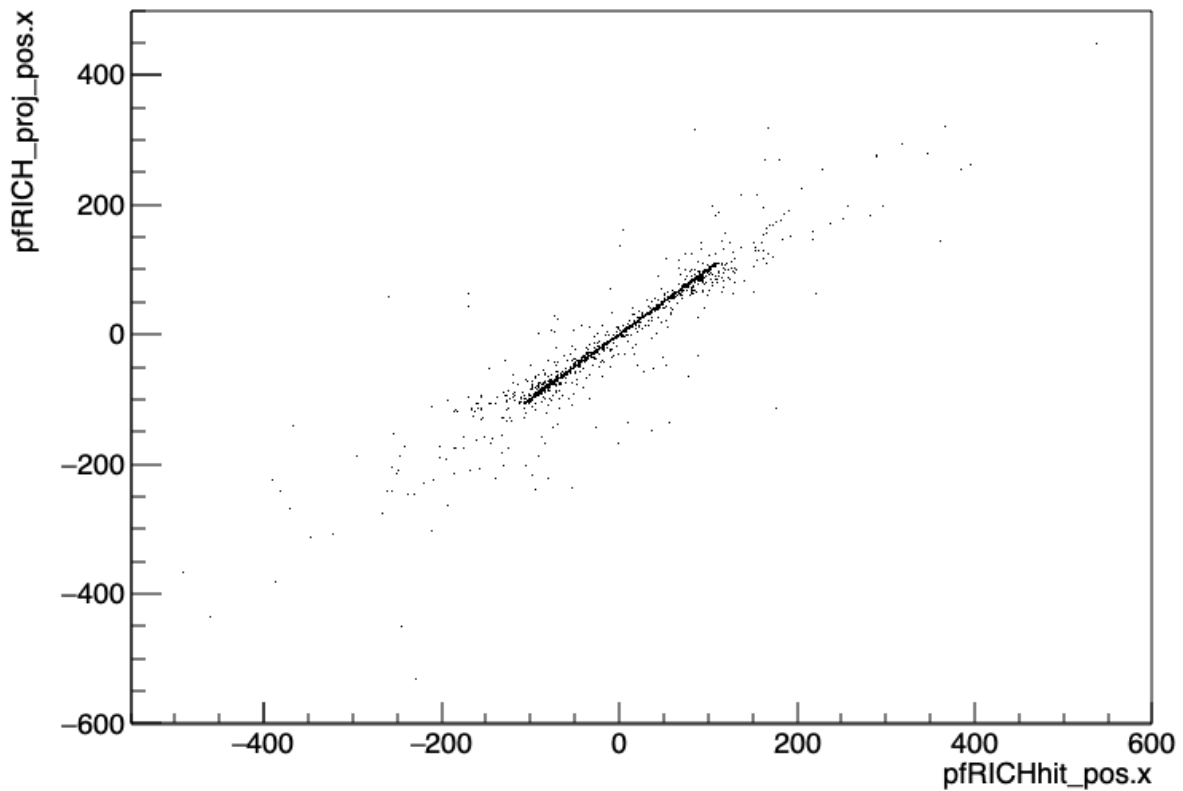
[TIC Meeting 3/10/24](#)



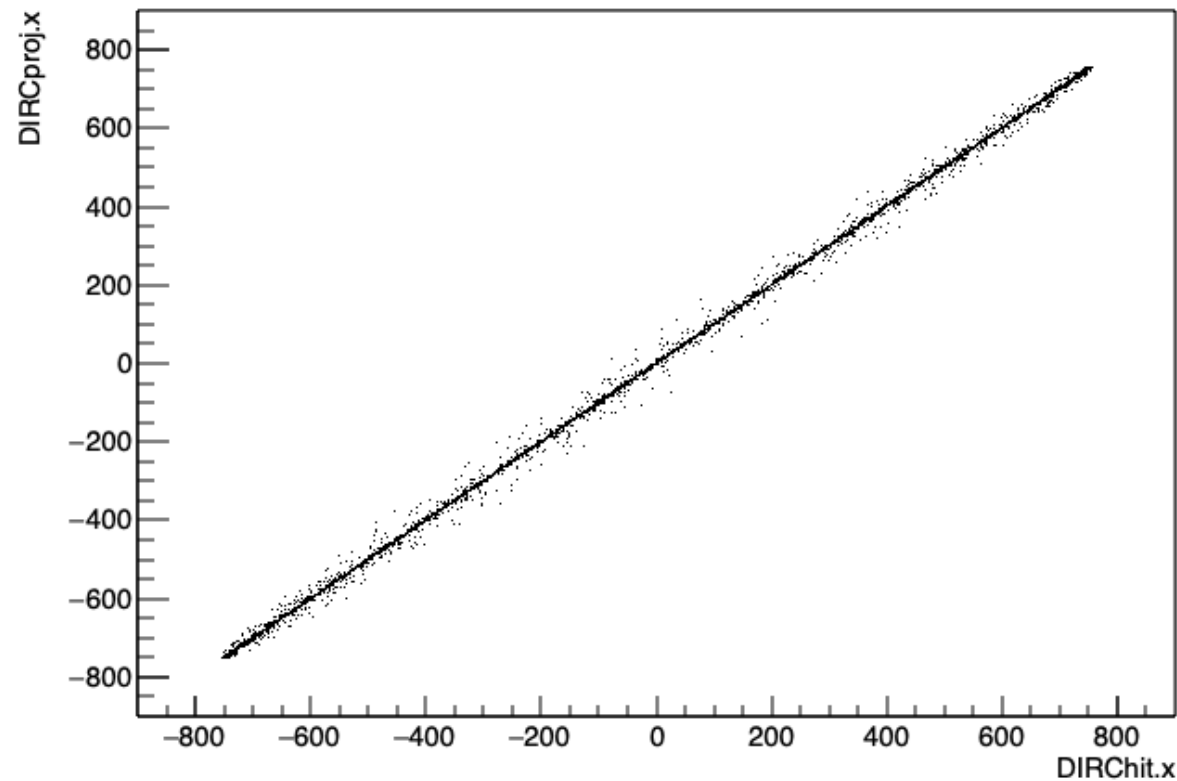
R. Wimmer



pfRICH\_proj\_pos.x:pfRICHhit\_pos.x {dR>0 && dR<1000}

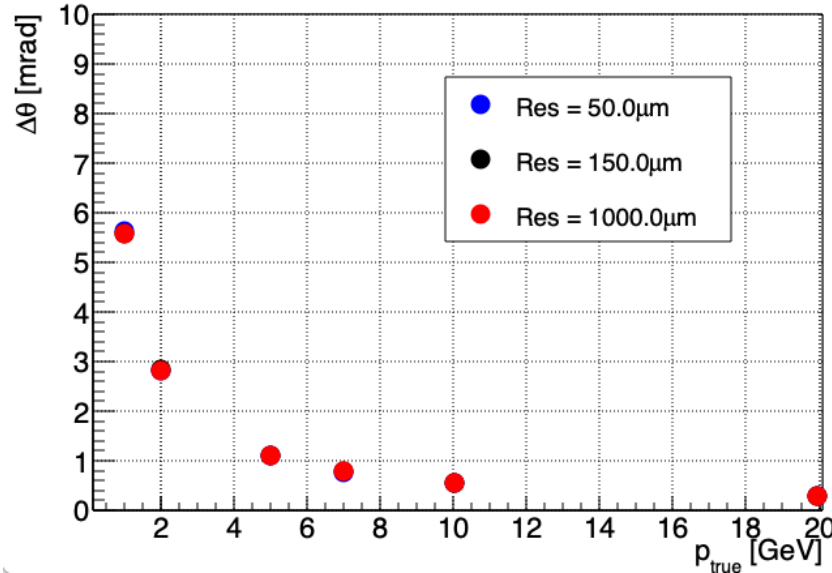


DIRCproj.x:DIRChit.x {DIRCres.dR>0&&DIRCres.dR<100}

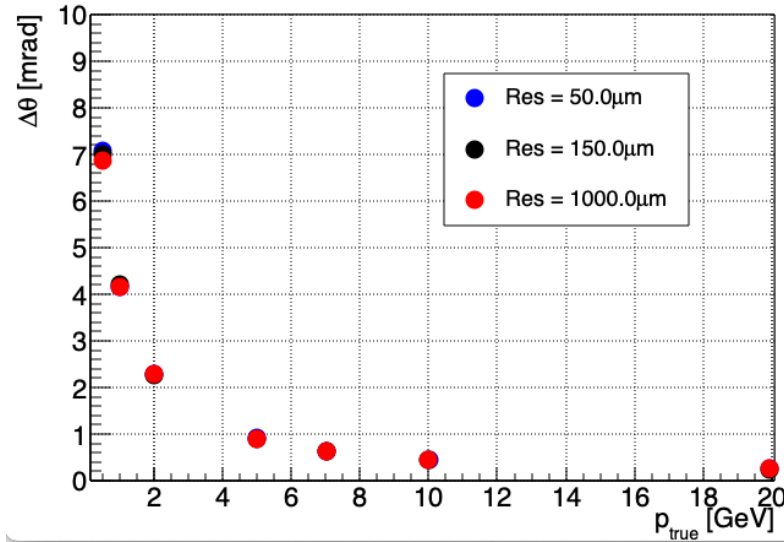


Single particle:  $\pi^-$ , ePIC 24.04.0, EICrecon v1.13.1

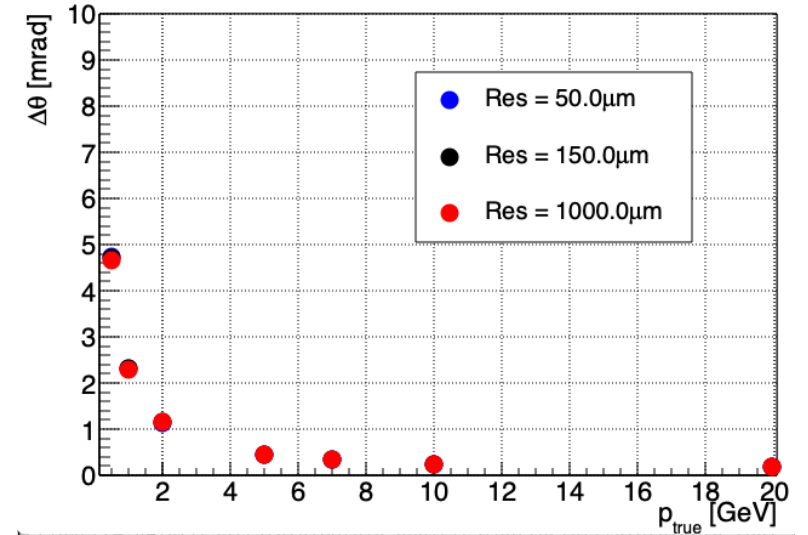
$152 < \theta < 154, \langle \eta \rangle = -1.43$



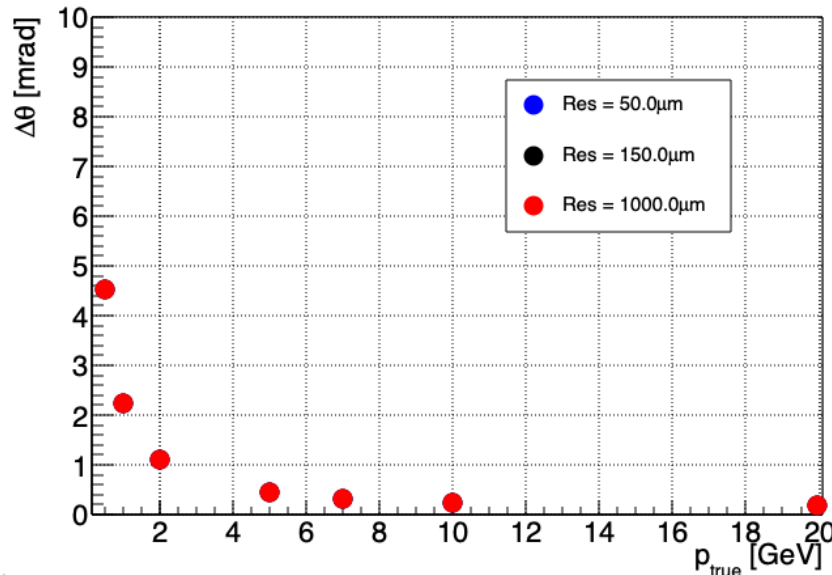
$156 < \theta < 158, \langle \eta \rangle = -1.59$



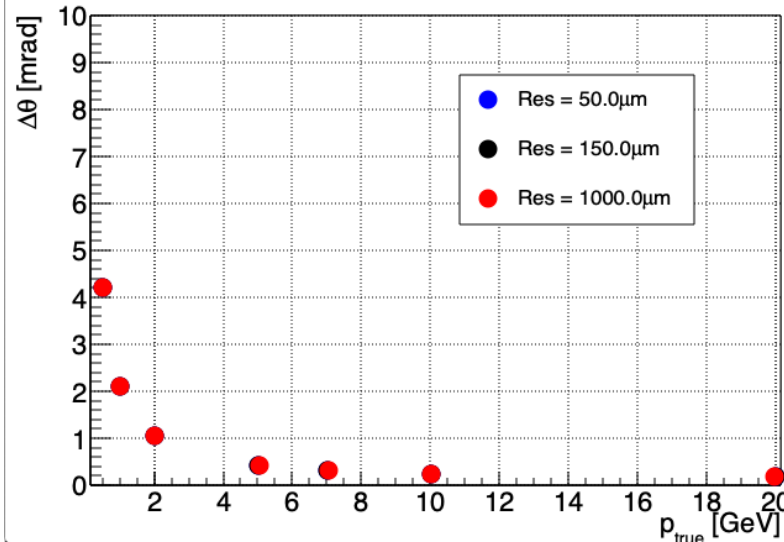
$164 < \theta < 166, \langle \eta \rangle = -2.03$



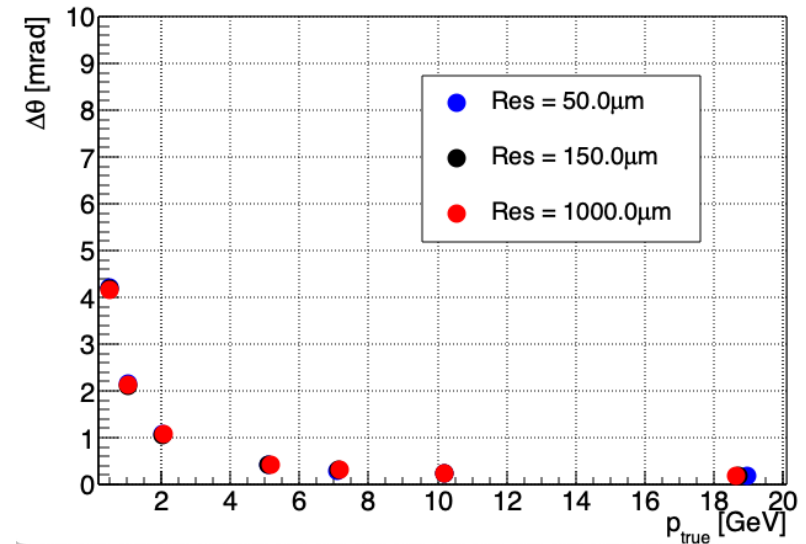
$168 < \theta < 170, \langle \eta \rangle = -2.34$



$172 < \theta < 174, \langle \eta \rangle = -2.80$



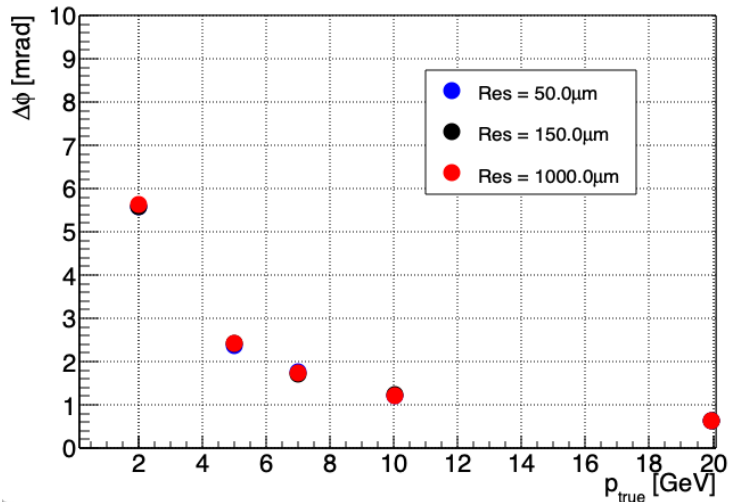
$175 < \theta < 177, \langle \eta \rangle = -3.39$



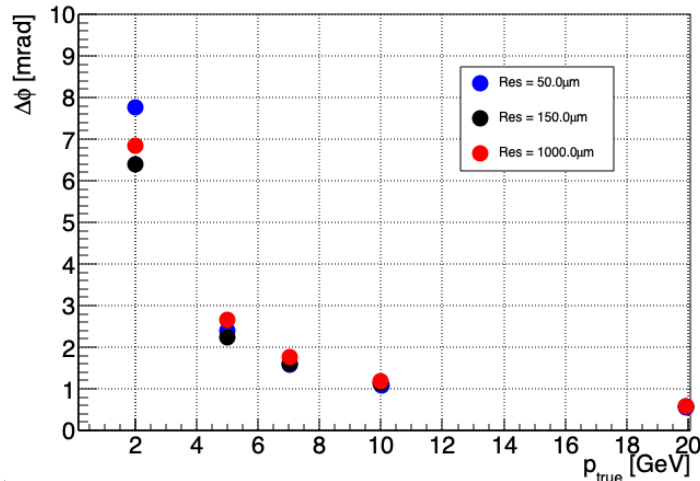


Single particle:  $\pi^-$ , ePIC 24.04.0, EICrecon v1.13.1

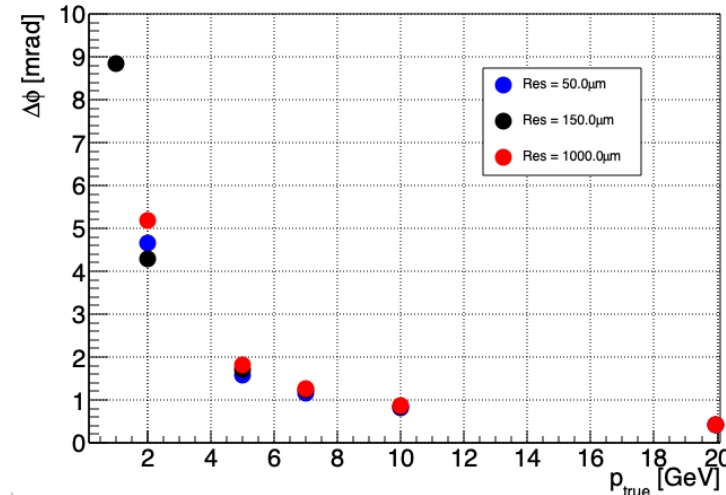
152 <math>\theta < 154</math>,  $\langle\eta\rangle = -1.43$



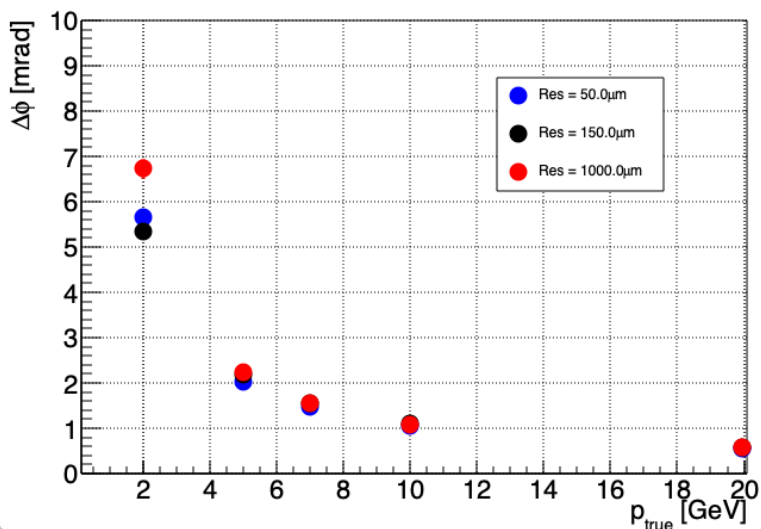
156 <math>\theta < 158</math>,  $\langle\eta\rangle = -1.59$



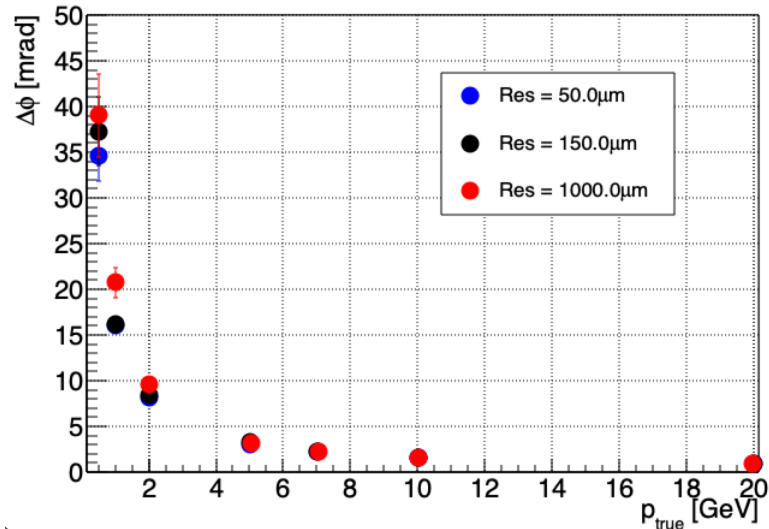
164 <math>\theta < 166</math>,  $\langle\eta\rangle = -2.03$



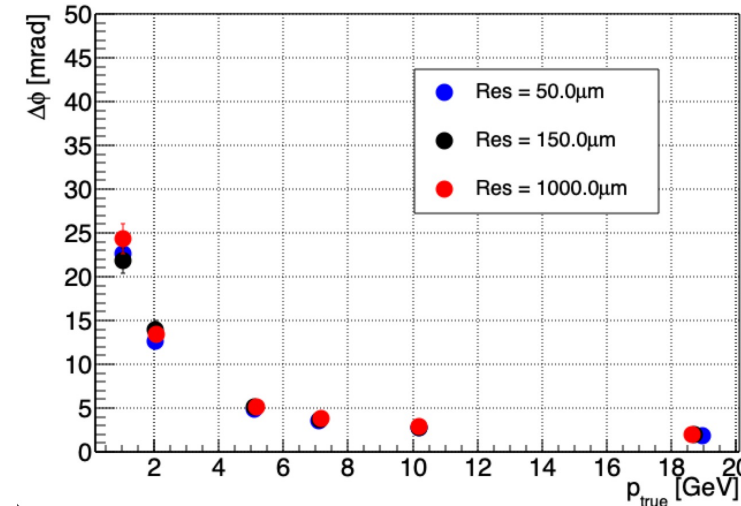
168 <math>\theta < 170</math>,  $\langle\eta\rangle = -2.34$



172 <math>\theta < 174</math>,  $\langle\eta\rangle = -2.80$

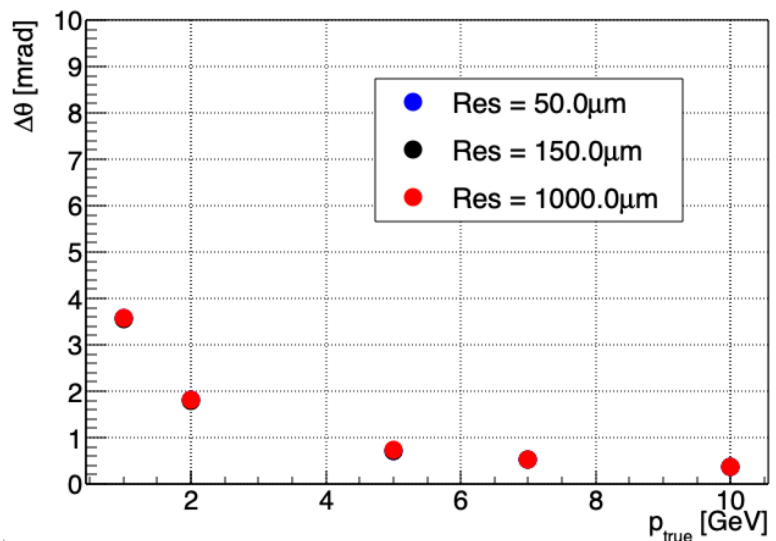


175 <math>\theta < 177</math>,  $\langle\eta\rangle = -3.39$

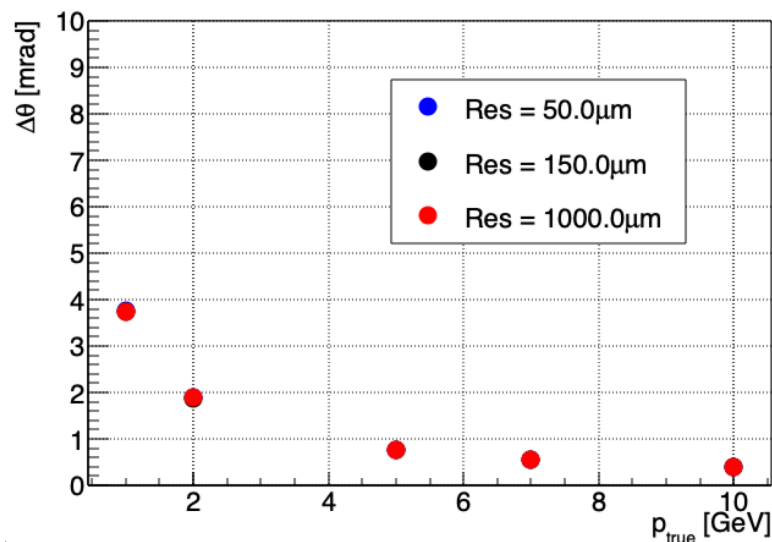


Single particle:  $\pi^-$ , ePIC 24.04.0, EICrecon v1.13.1

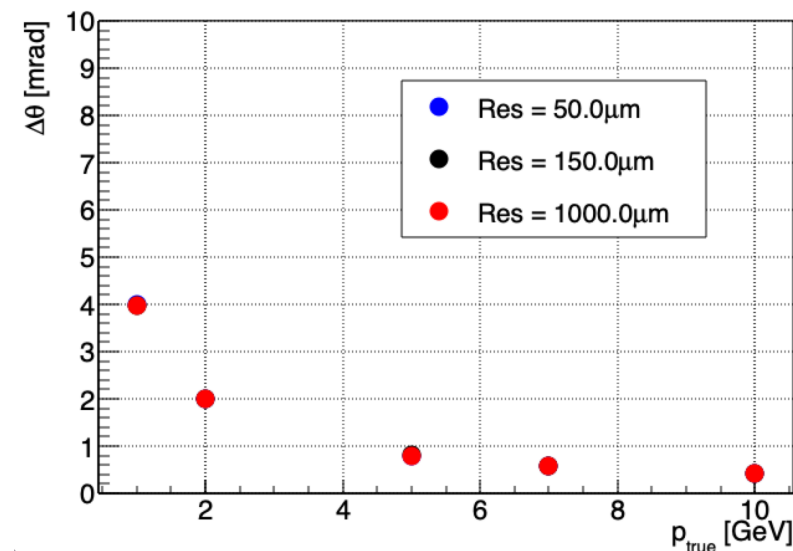
$72 < \theta < 74, \langle \eta \rangle = 0.30$



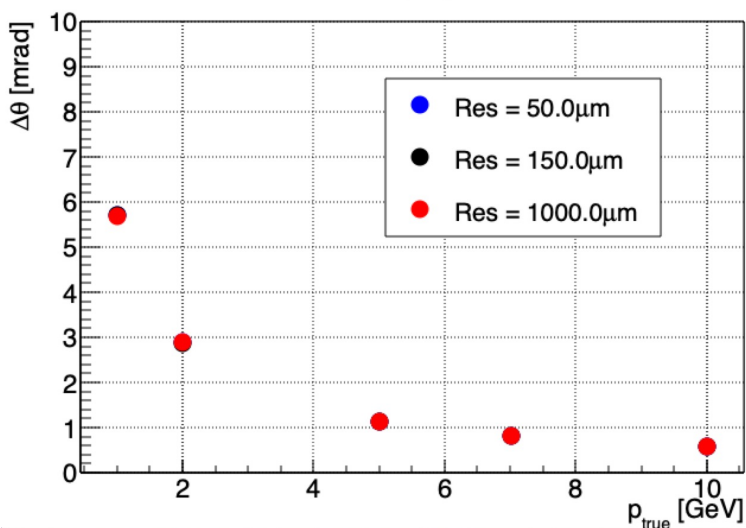
$62 < \theta < 64, \langle \eta \rangle = 0.49$



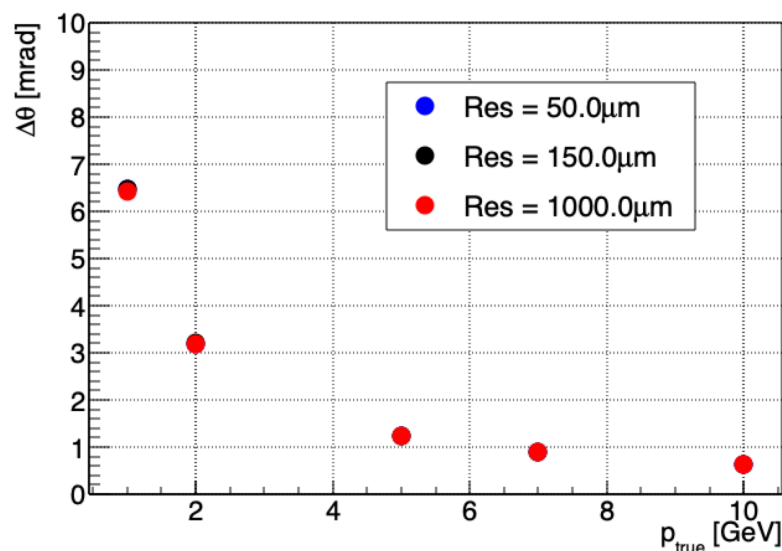
$52 < \theta < 54, \langle \eta \rangle = 0.70$



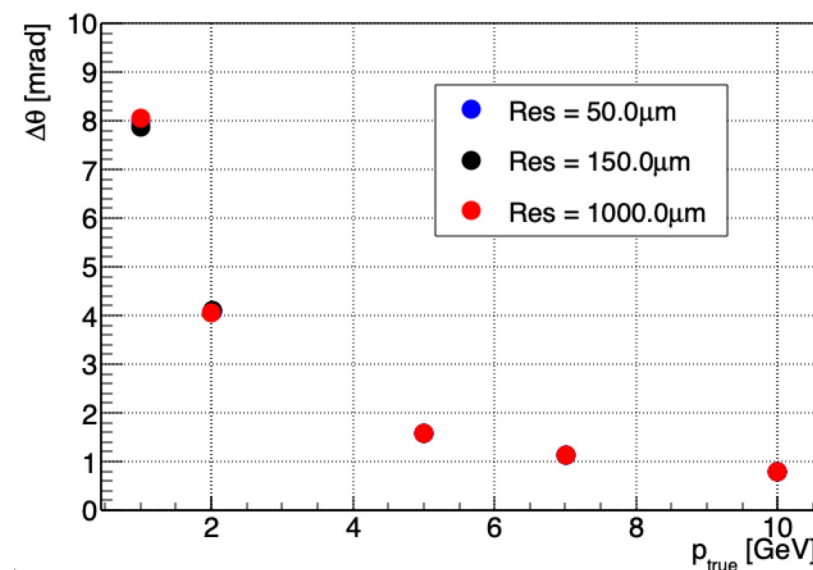
$42 < \theta < 44, \langle \eta \rangle = 0.93$



$32 < \theta < 34, \langle \eta \rangle = 1.22$

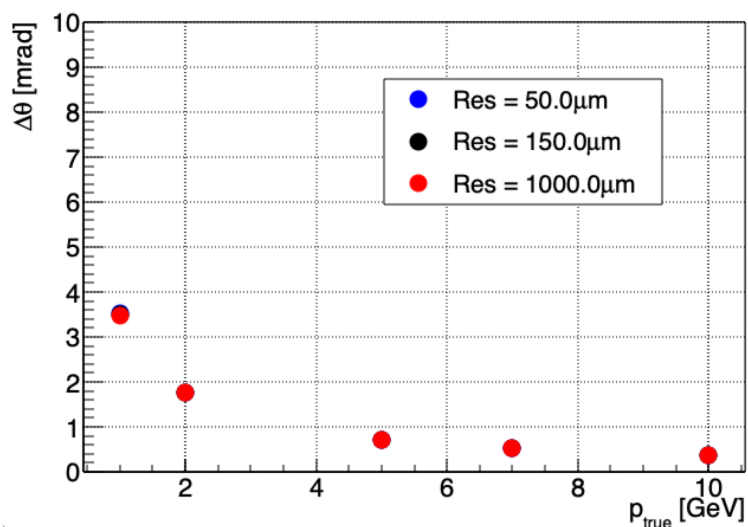


$22 < \theta < 24, \langle \eta \rangle = 1.59$

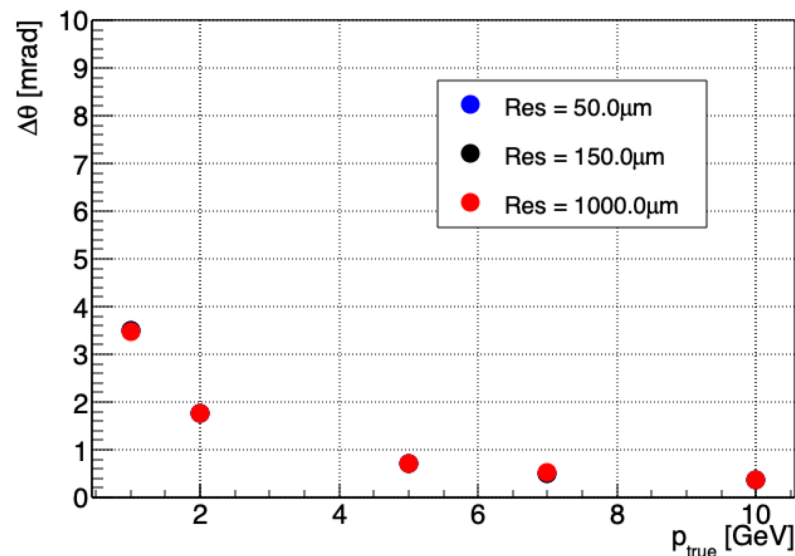


Single particle:  $\pi^-$ , ePIC 24.04.0, EICrecon v1.13.1

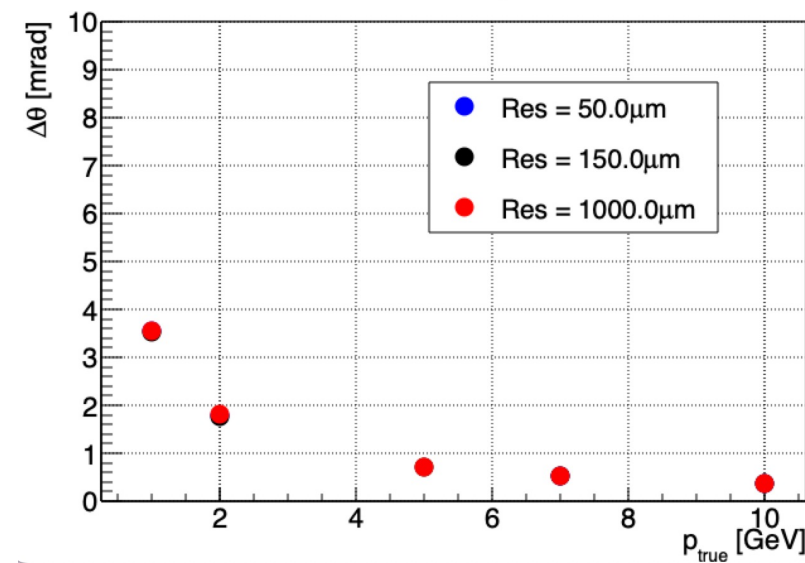
$82 < \theta < 84, \langle \eta \rangle = 0.12$



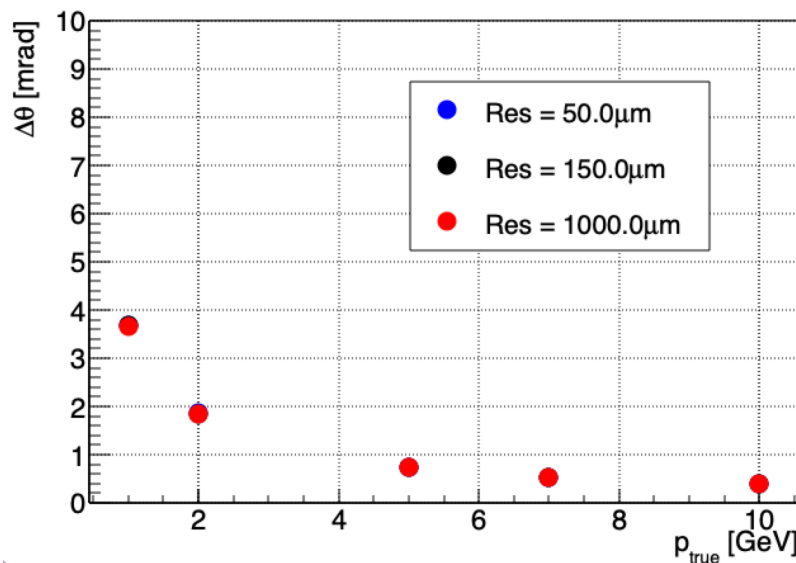
$92 < \theta < 94, \langle \eta \rangle = -0.05$



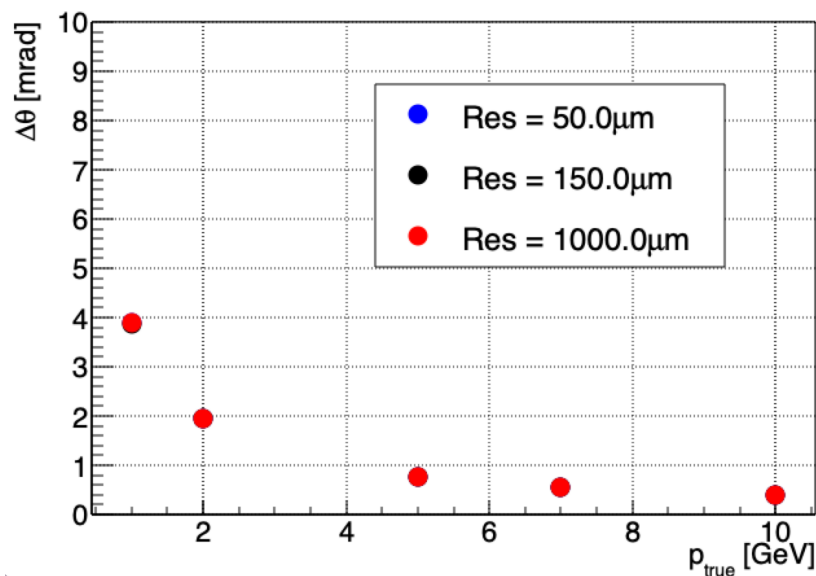
$102 < \theta < 104, \langle \eta \rangle = -0.23$



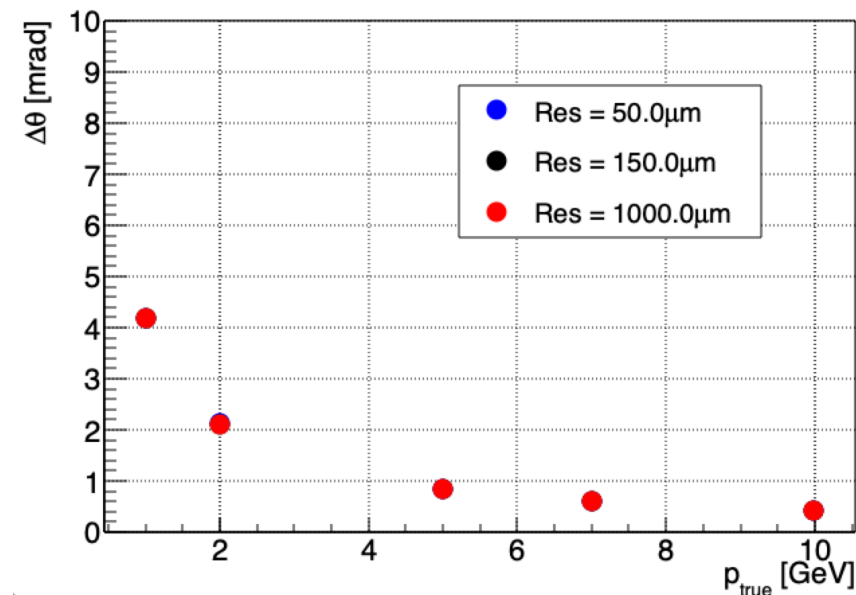
$112 < \theta < 114, \langle \eta \rangle = -0.41$



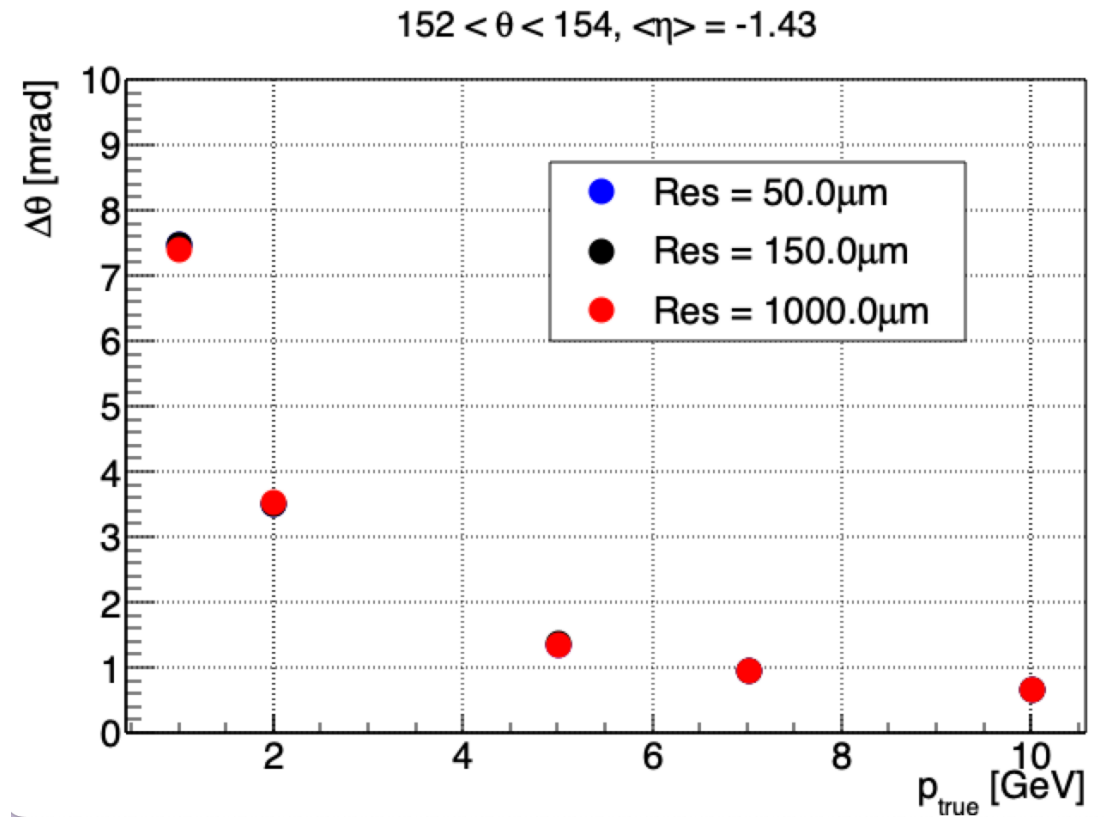
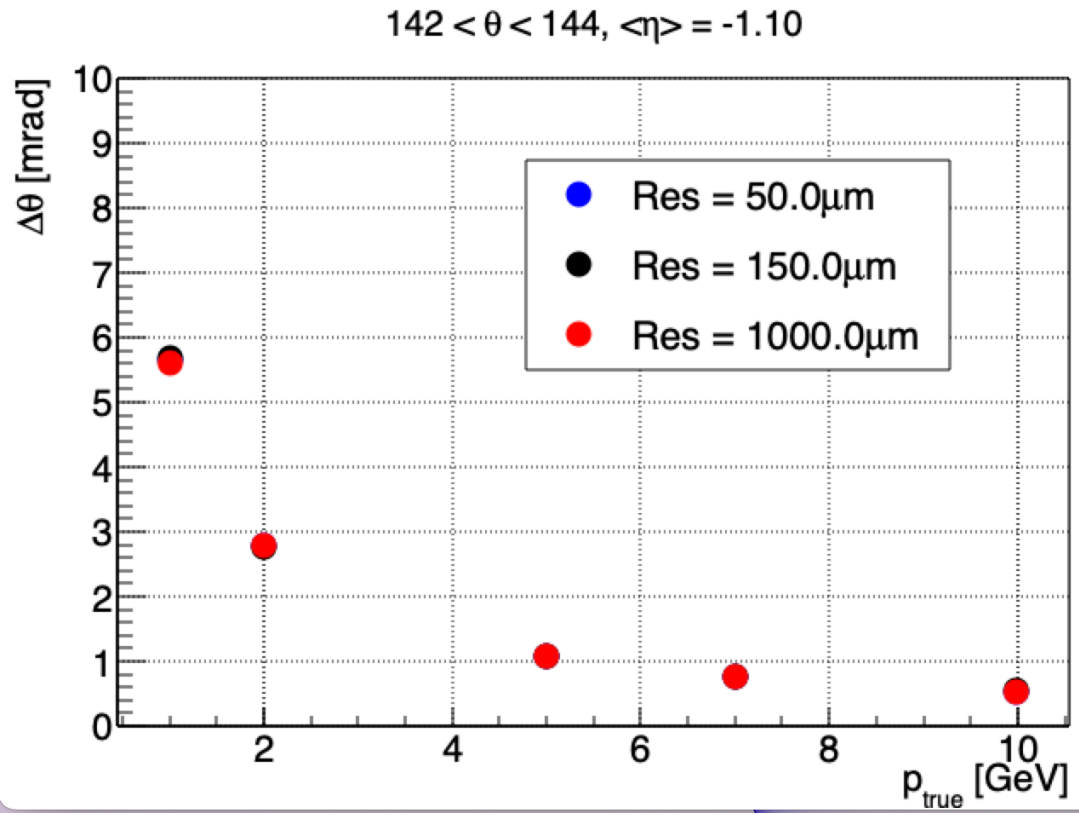
$122 < \theta < 124, \langle \eta \rangle = -0.61$



$132 < \theta < 134, \langle \eta \rangle = -0.83$

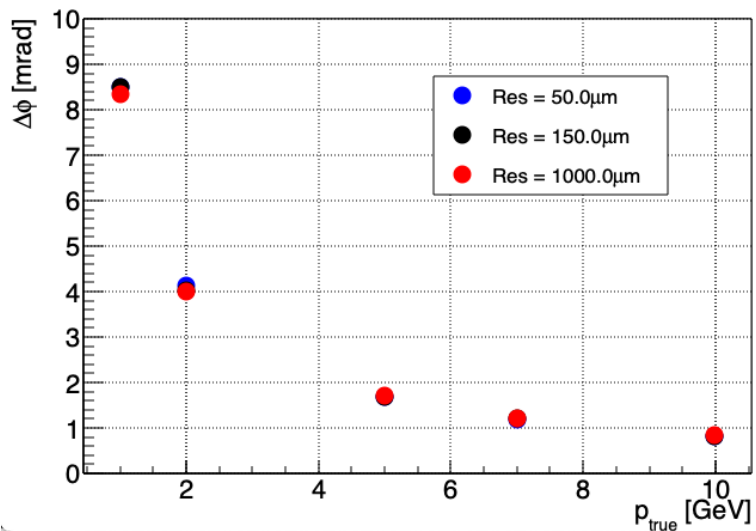


□ Single particle:  $\pi^-$ , ePIC 24.04.0, ElCrecon v1.13.1

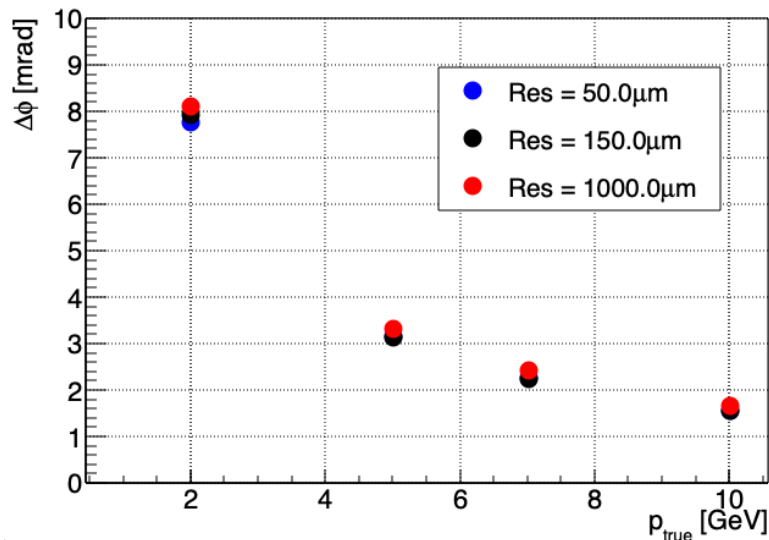


Single particle:  $\pi^-$ , ePIC 24.04.0, EICrecon v1.13.1

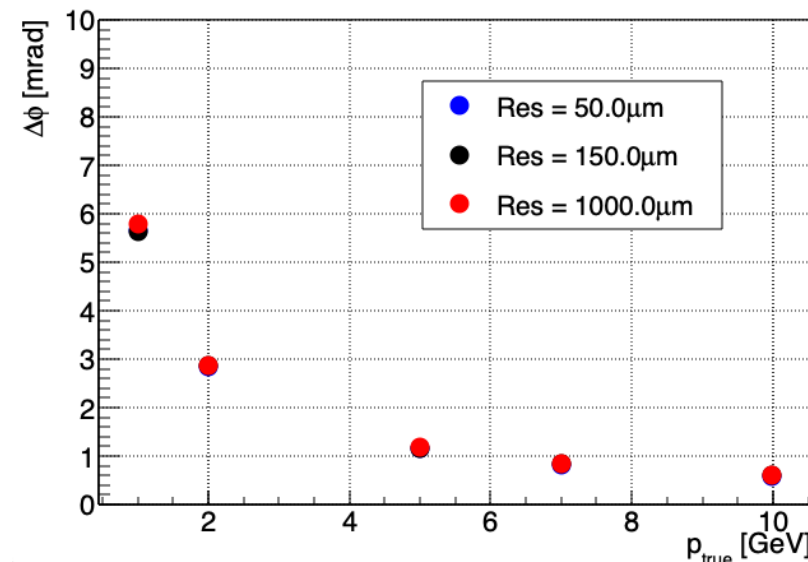
$142 < \theta < 144, \langle \eta \rangle = -1.10$



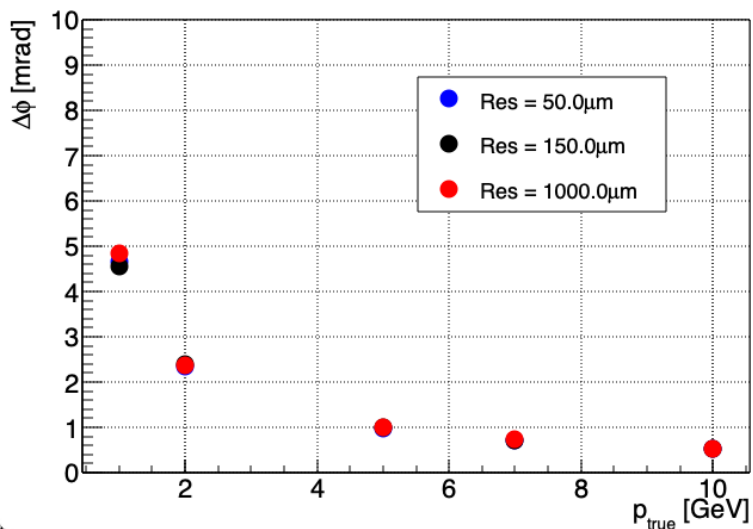
$152 < \theta < 154, \langle \eta \rangle = -1.43$



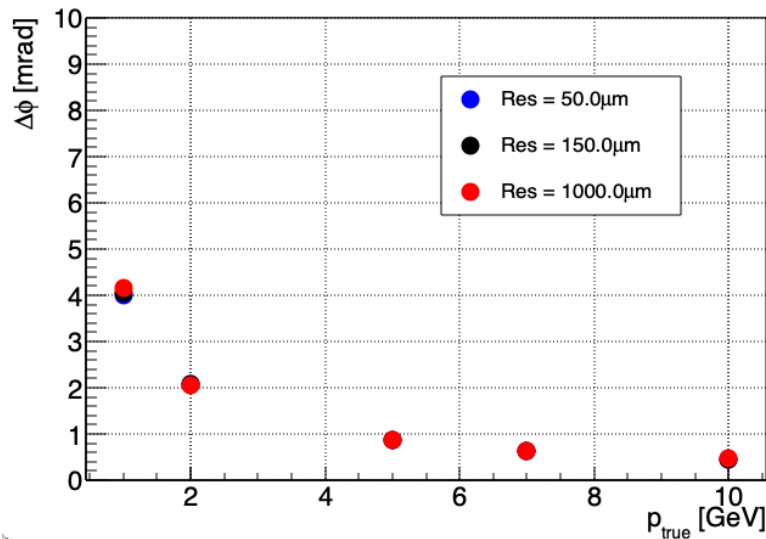
$132 < \theta < 134, \langle \eta \rangle = -0.83$



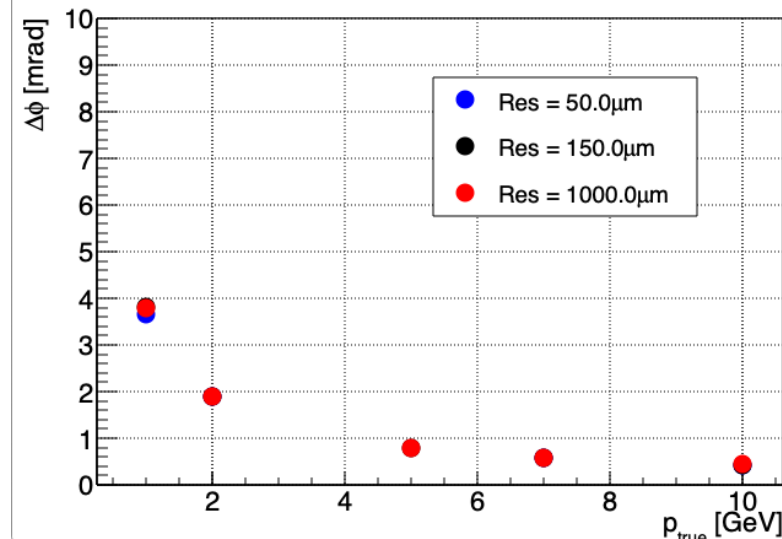
$122 < \theta < 124, \langle \eta \rangle = -0.61$



$112 < \theta < 114, \langle \eta \rangle = -0.41$

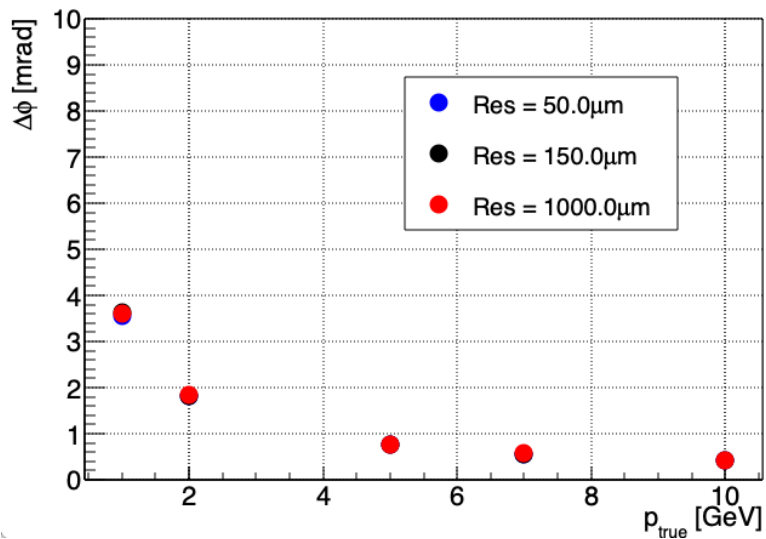


$102 < \theta < 104, \langle \eta \rangle = -0.23$

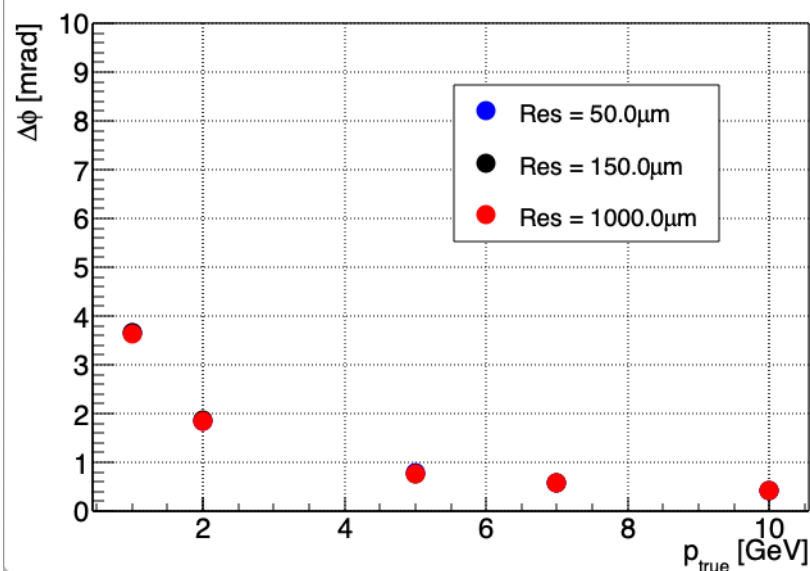


Single particle:  $\pi^-$ , ePIC 24.04.0, EICrecon v1.13.1

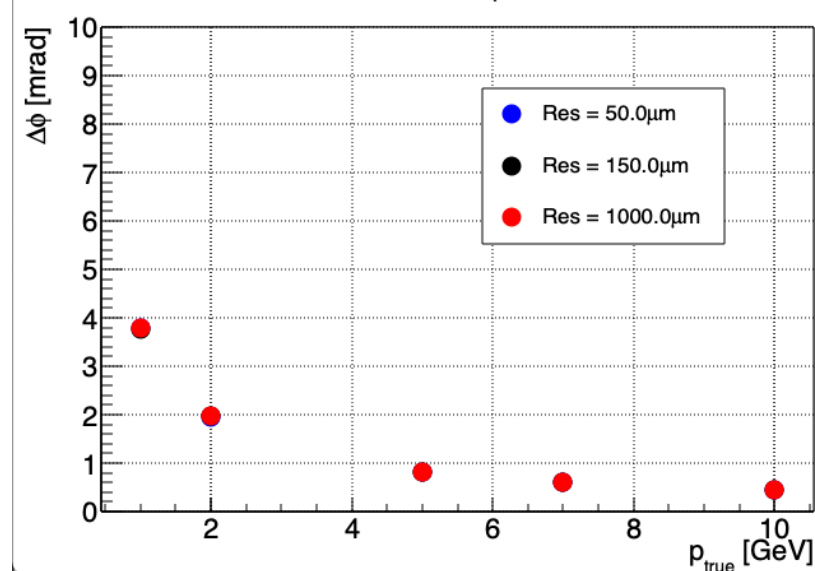
92 <math>\theta</math> <math>94</math>, <math>\langle\eta\rangle = -0.05</math>



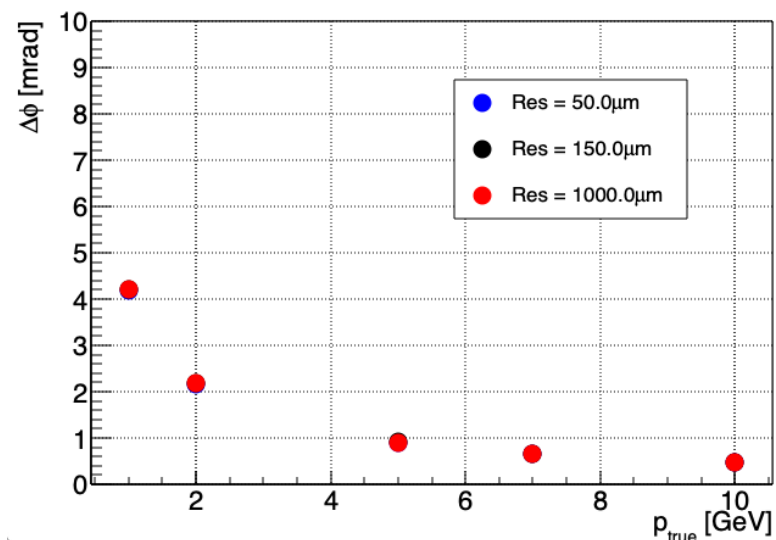
82 <math>\theta</math> <math>84</math>, <math>\langle\eta\rangle = 0.12</math>



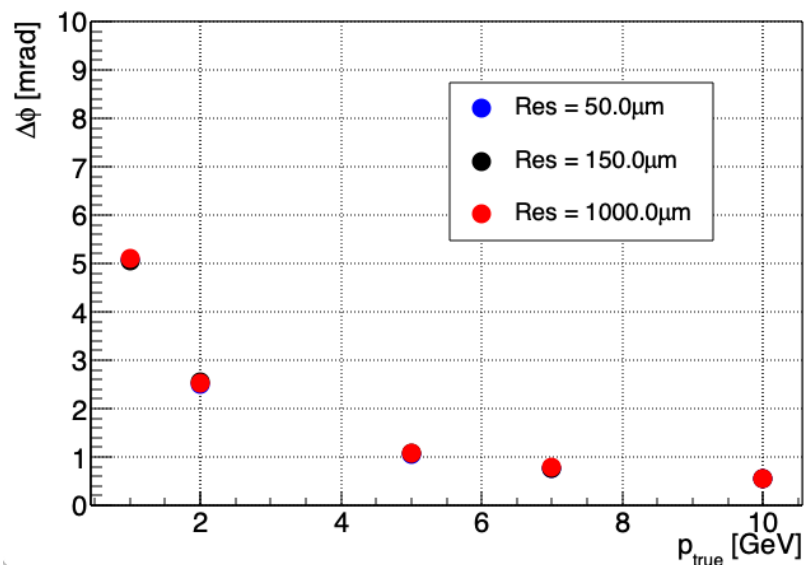
72 <math>\theta</math> <math>74</math>, <math>\langle\eta\rangle = 0.30</math>



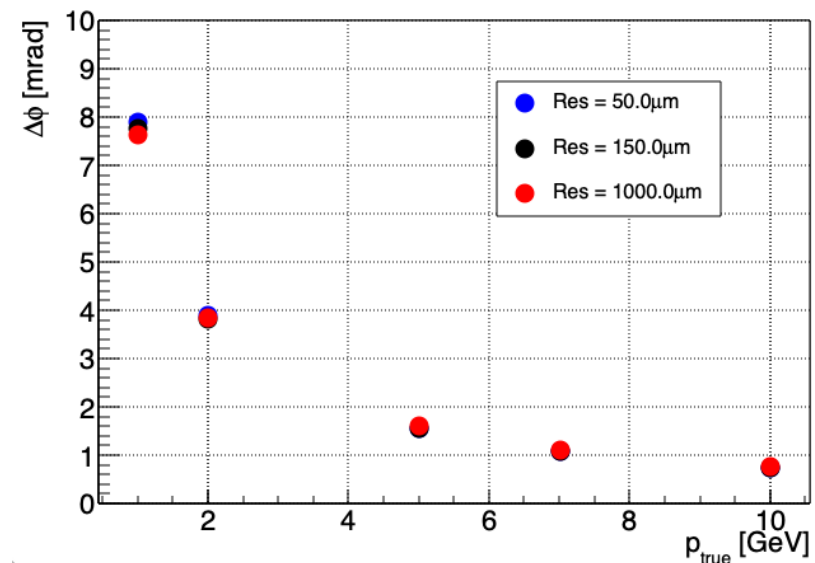
62 <math>\theta</math> <math>64</math>, <math>\langle\eta\rangle = 0.49</math>



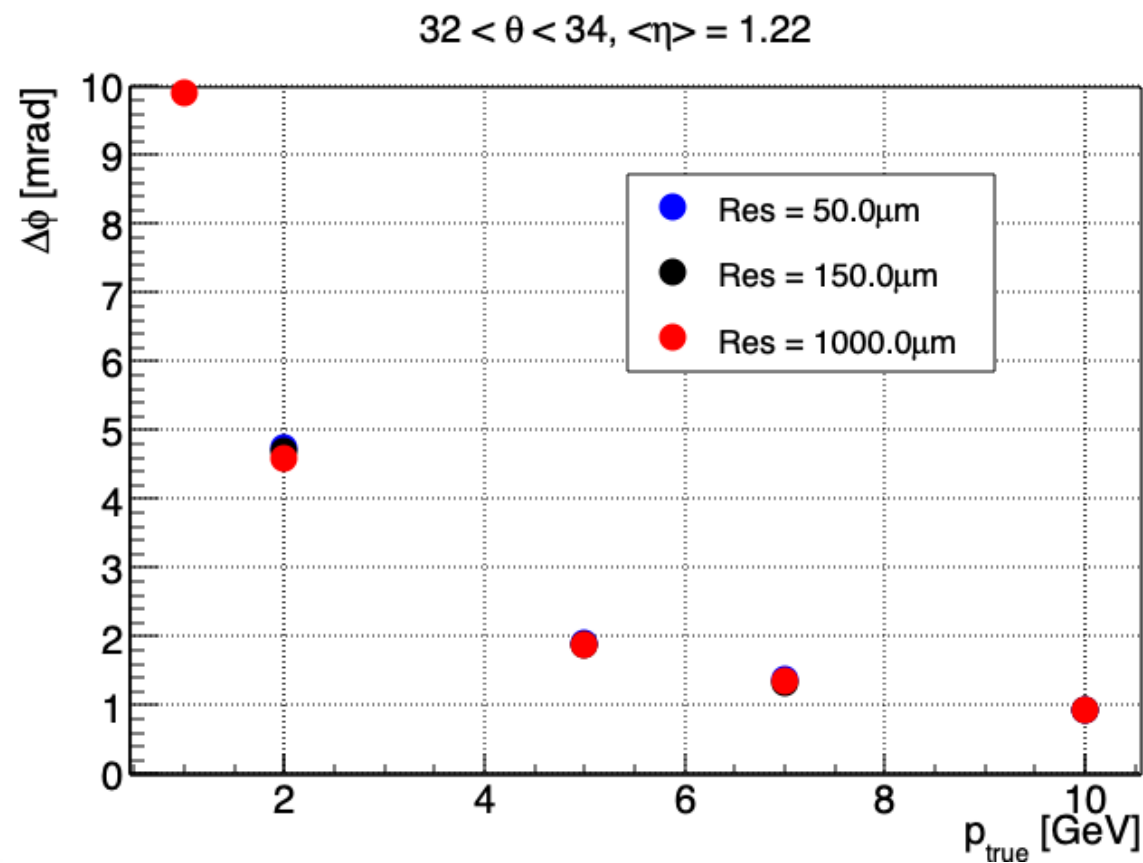
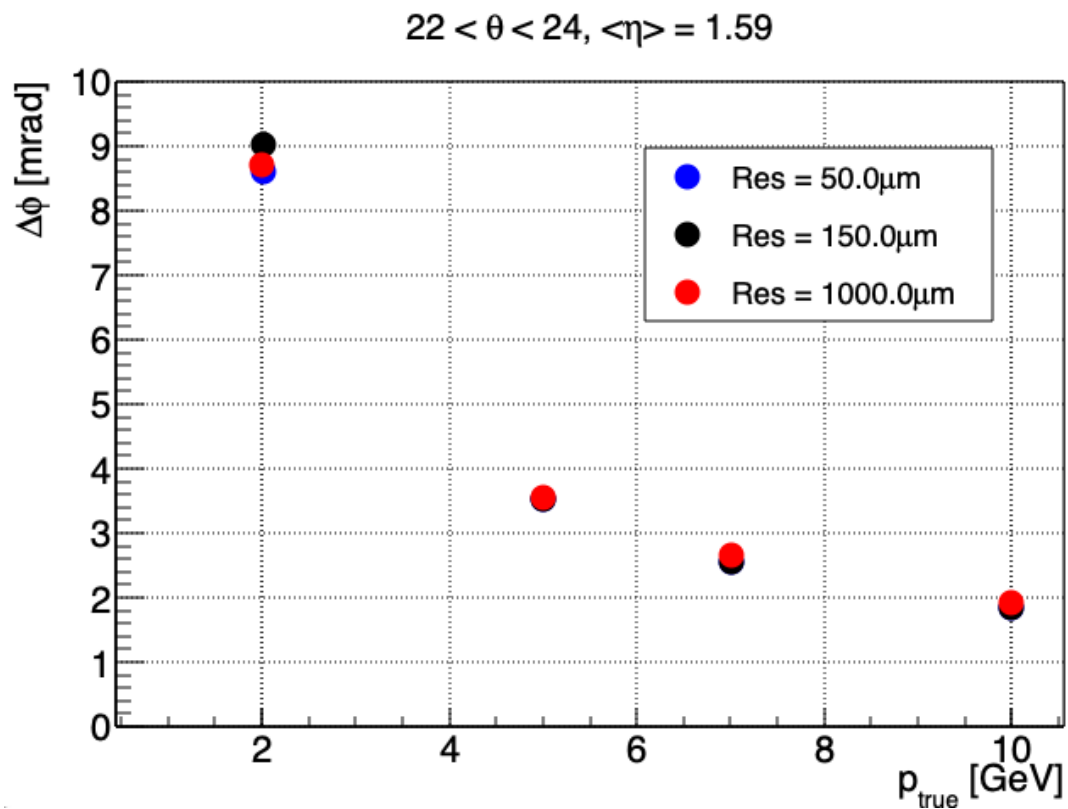
52 <math>\theta</math> <math>54</math>, <math>\langle\eta\rangle = 0.70</math>



42 <math>\theta</math> <math>44</math>, <math>\langle\eta\rangle = 0.93</math>



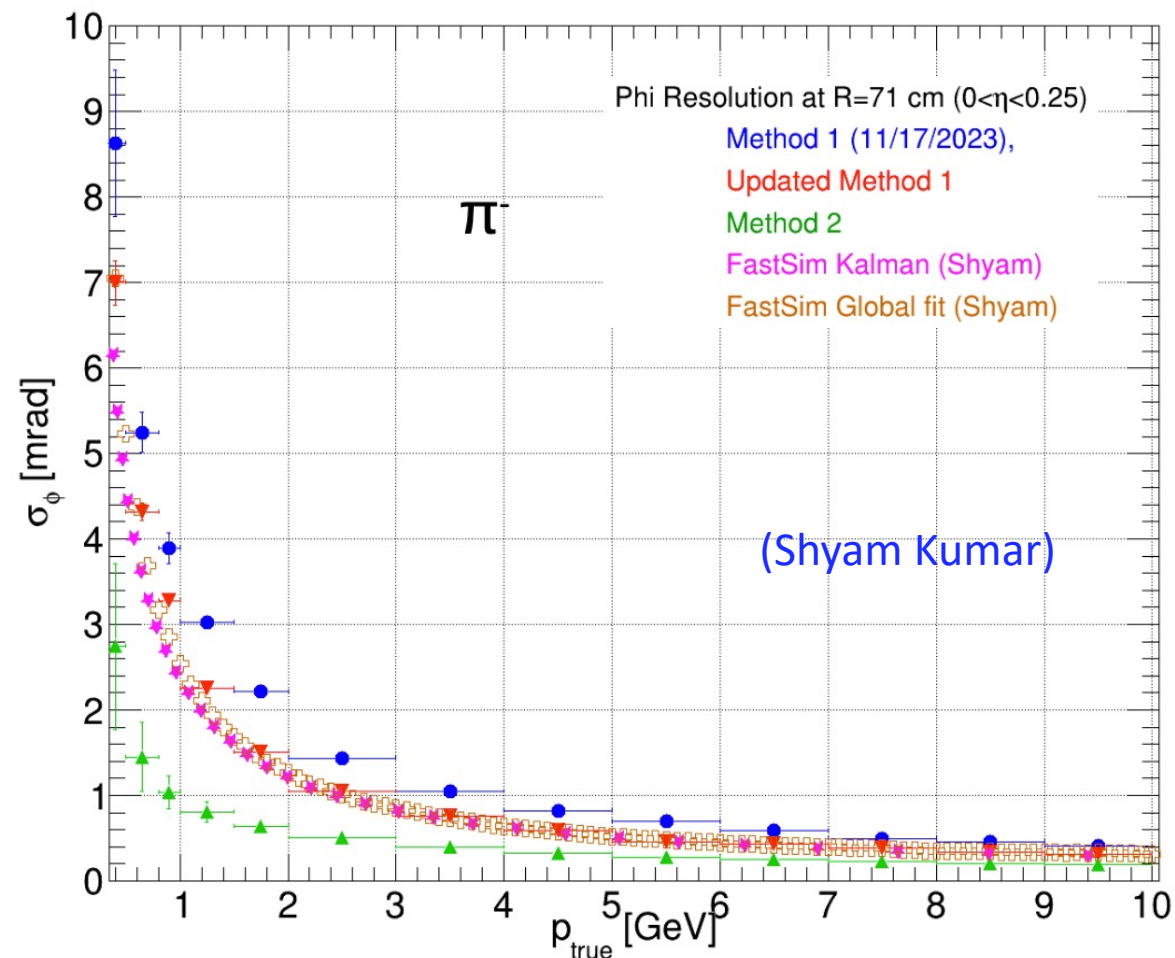
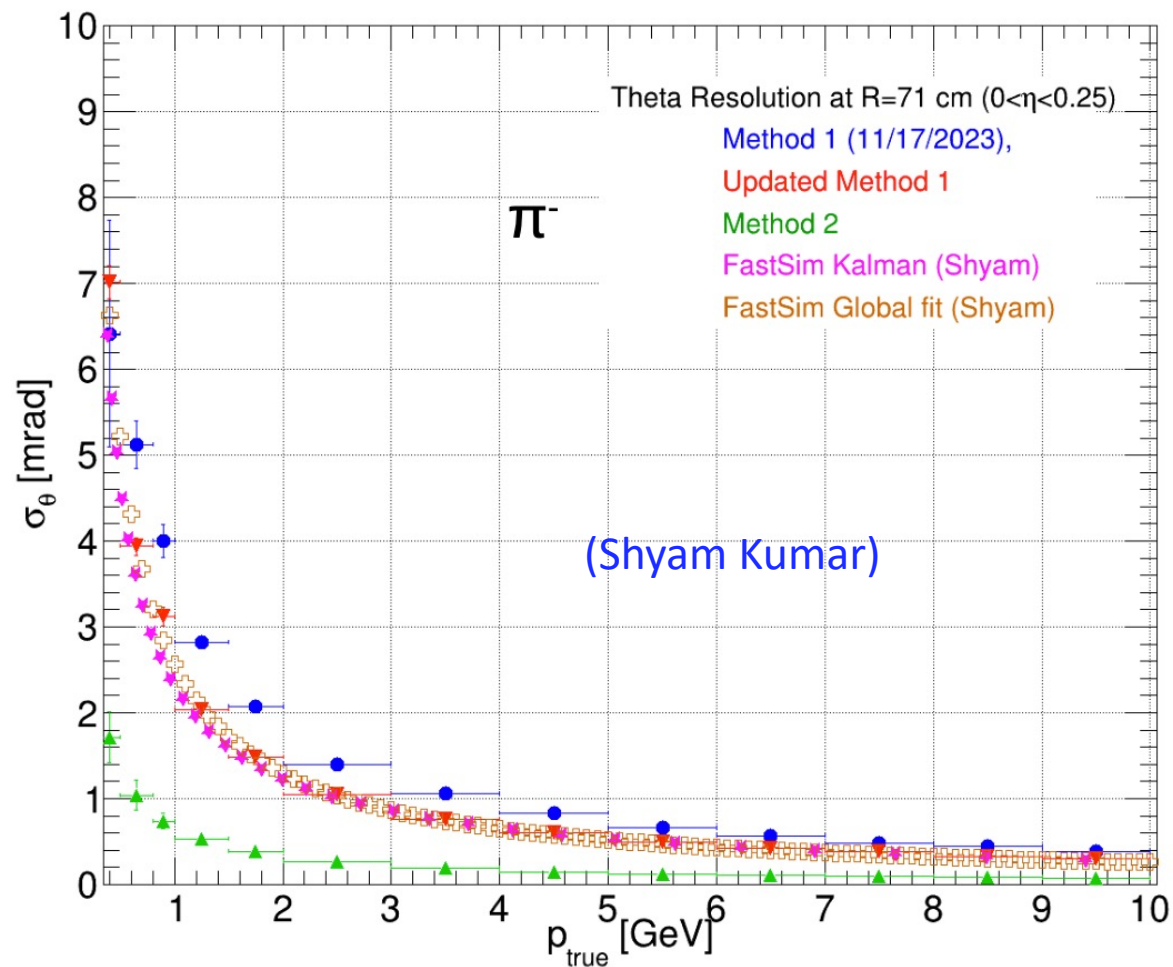
□ Single particle:  $\pi^-$ , ePIC 24.04.0, ElCrecon v1.13.1



# Comparison to Fast Simulation Results

- Good agreement between ePIC (Updated Method 1) and fast simulations

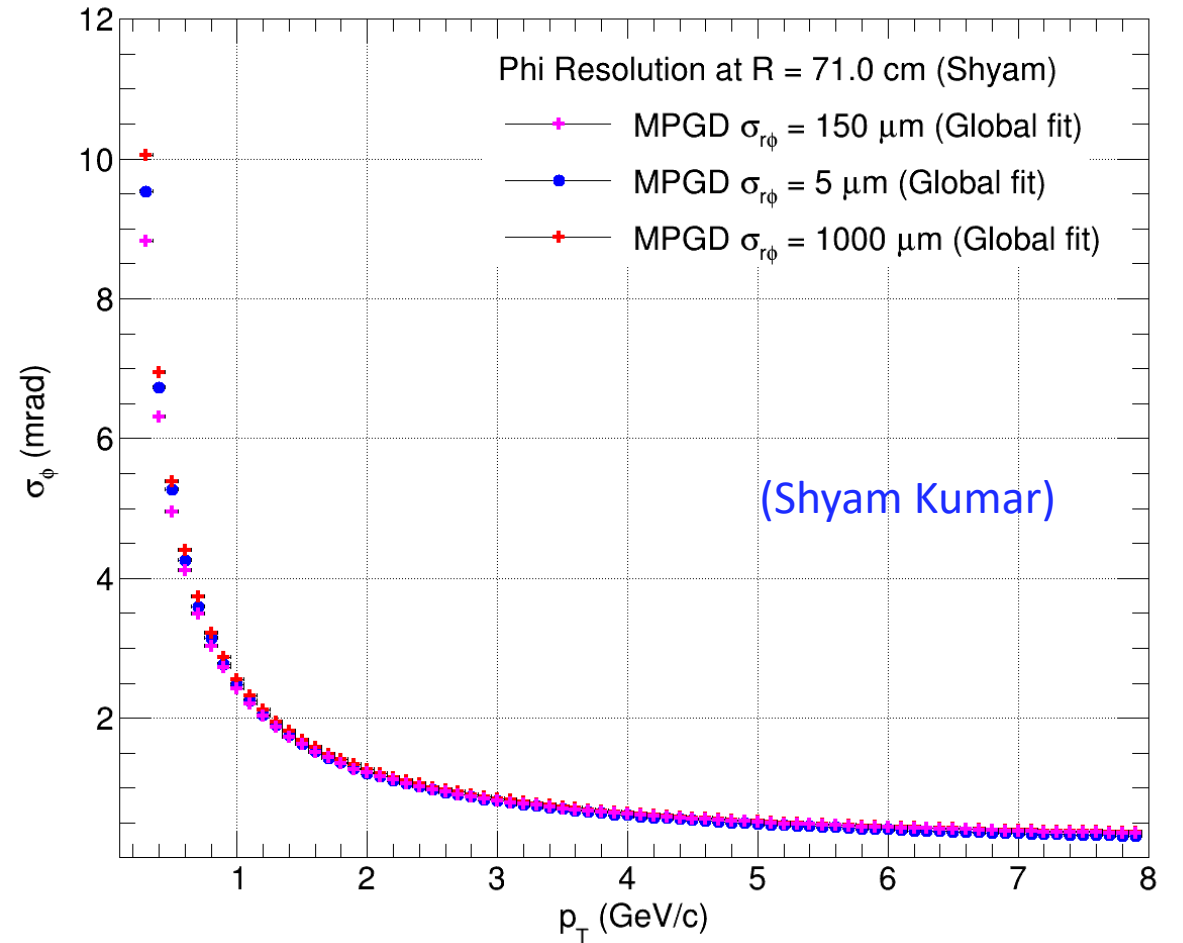
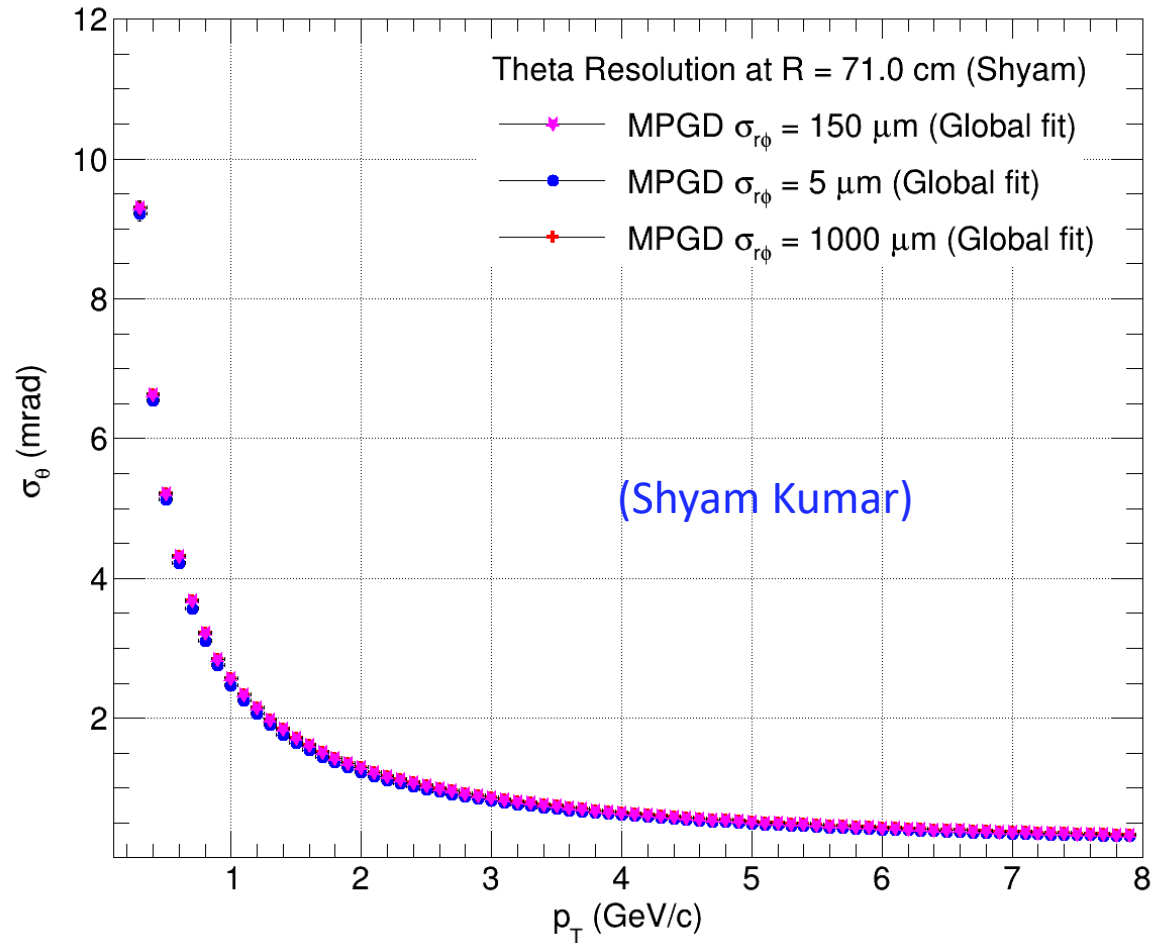
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# Impact of MPGD Resolutions: Fast Simulation

- ❑ Fast simulations show angular resolutions not very sensitive to MPGD resolution
  - Agrees with behavior found in ePIC simulations



# Angular Resolution Contributions: Fast Simulation

- Fast simulation shows angular resolutions dominated by multiple scattering
  - Consistent with angular resolutions not being very sensitive to MPGD spatial resolutions (S.R.)

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