

Study pointing resolution

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Requirement

Yellow report

Table 8.5: Requested vertex position resolution.

Pseudorapidity Range	Resolution
$-3.5 < \eta < -3.0$	N/A
$-3.0 < \eta < -2.5$	$\sigma_{xy} \sim 30/p_T \oplus 40 \mu\text{m}$
$-2.5 < \eta < -1.0$	$\sigma_{xy} \sim 30/p_T \oplus 20 \mu\text{m}$
$-1.0 < \eta < 1.0$	$\sigma_{xy} \sim 20/p_T \oplus 5 \mu\text{m}$
$1.0 < \eta < 2.5$	$\sigma_{xy} \sim 30/p_T \oplus 20 \mu\text{m}$
$2.5 < \eta < 3.0$	$\sigma_{xy} \sim 30/p_T \oplus 40 \mu\text{m}$
$3.0 < \eta < 3.5$	$\sigma_{xy} \sim 30/p_T \oplus 60 \mu\text{m}$

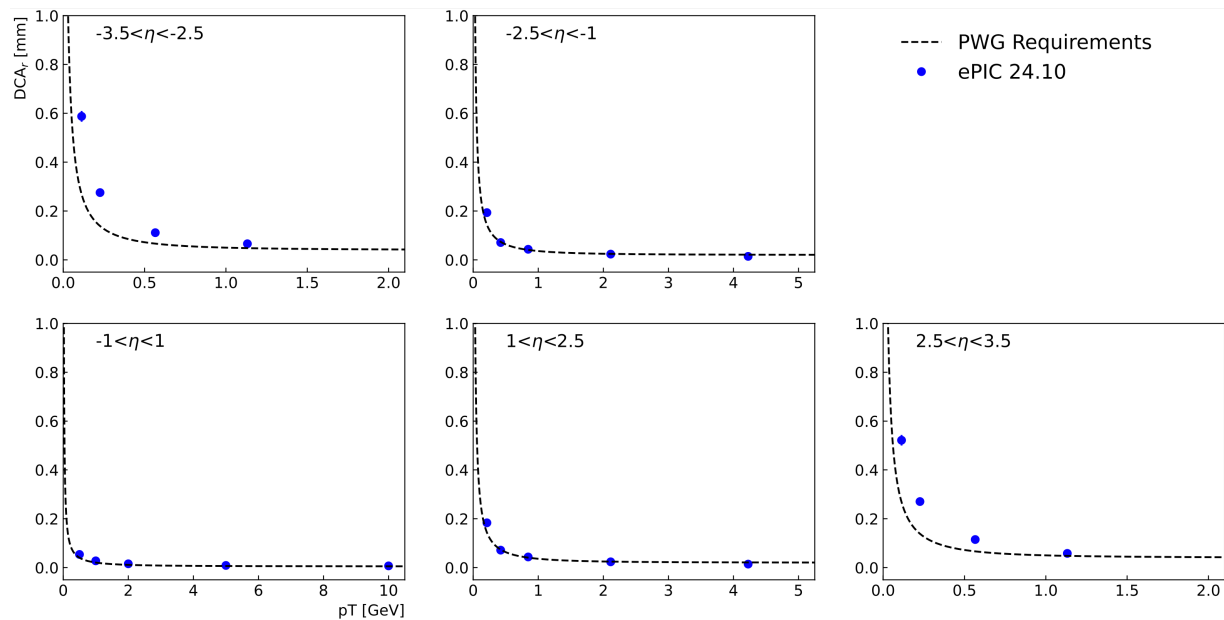
preTDR

η range	dp/p [%]	DCA_r [μm]
$(-3.5, -2.5)$	$0.10 \times p \oplus 2.0$	$30/p_T \oplus 40$
$(-2.5, -1.0)$	$0.05 \times p \oplus 1.0$	$30/p_T \oplus 20$
$(-1.0, 1.0)$	$0.05 \times p \oplus 0.5$	$20/p_T \oplus 5$
$(1.0, 2.5)$	$0.05 \times p \oplus 1.0$	$30/p_T \oplus 20$
$(2.5, 3.5)$	$0.10 \times p \oplus 2.0$	$30/p_T \oplus 40$

- No explicit requirement for σ_z

preTDR

- Single pions at the nominal collision vertex of (0,0,0)



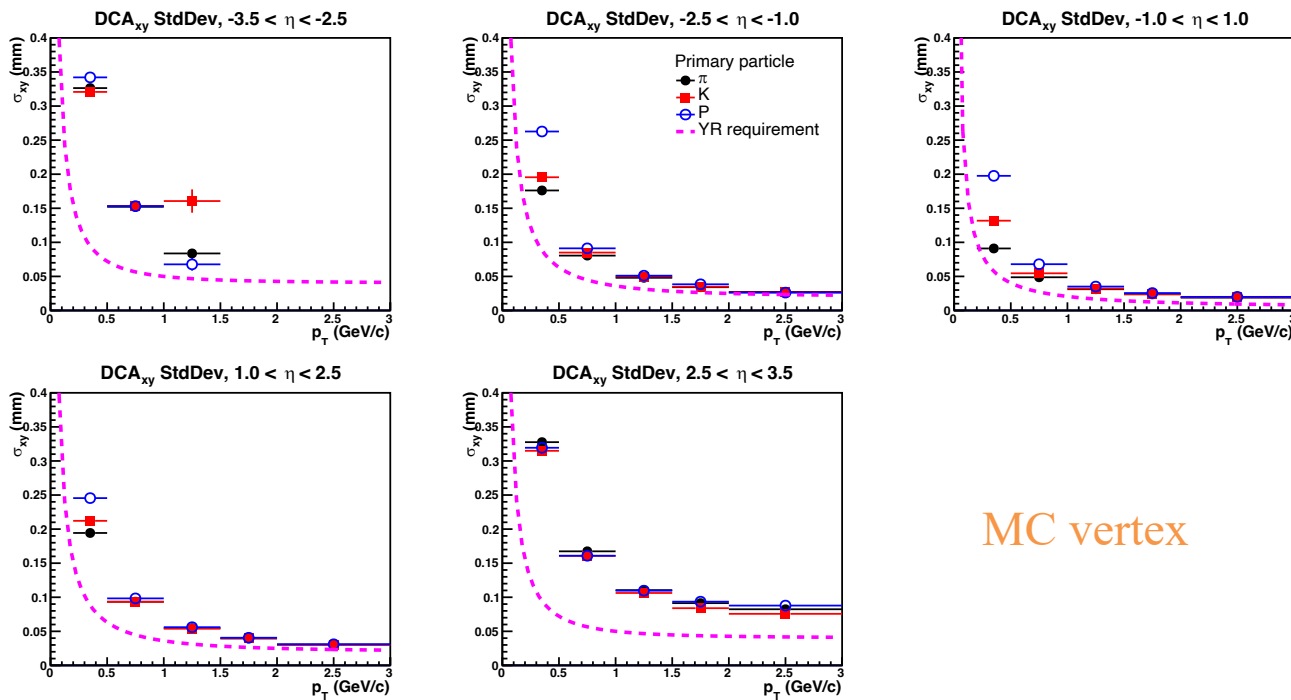
Analysis setup

- Simulation sample
 - NC DIS events
 - ep @ 10x100
 - $Q^2 > 1 \text{ (GeV/c)}^2$
 - Simulation campaign: 25.04.1
- Track selection
 - Primary tracks
 - Truth PID

Quantify DCA resolution

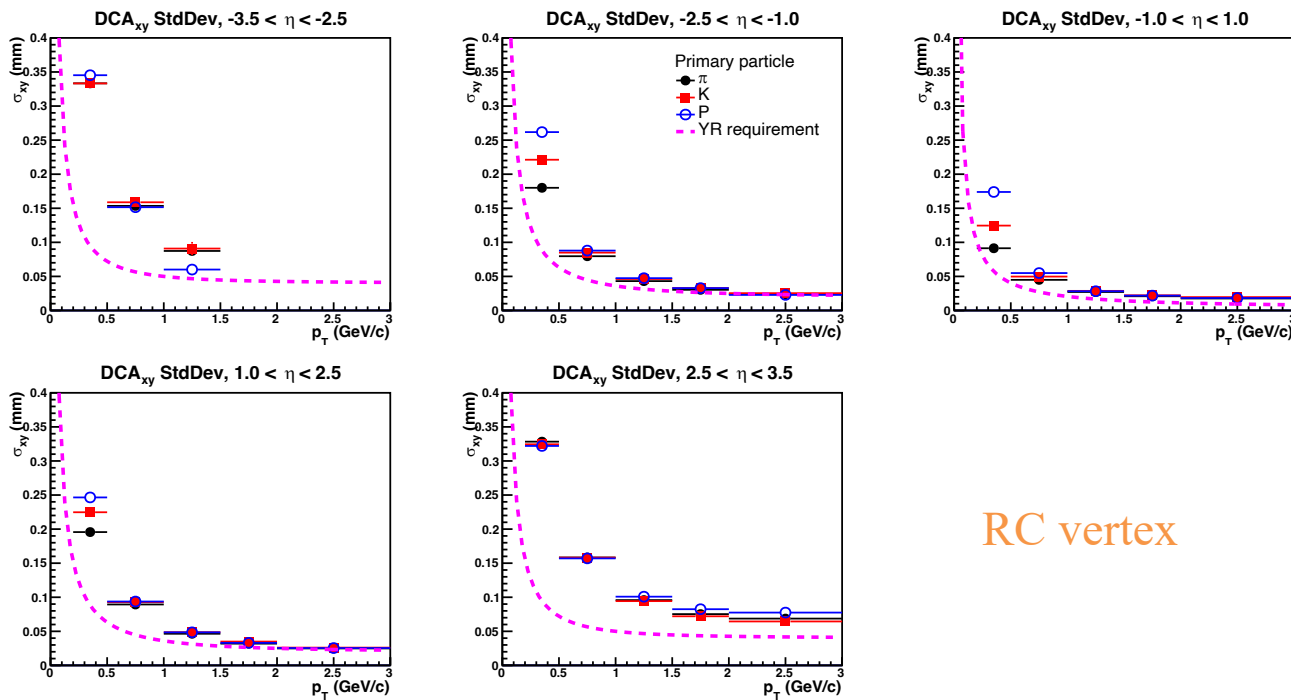
- DCA calculation
 - Based on helix swimming to **MC** primary vertex
 - DCA_{xy} : DCA **in x-y plane** between primary track and primary vertex
 - DCA_z : z component of **3D** DCA
- Quantify DCA
 - Iterative standard deviation
 - Get standard deviation within $[-5*StdDev, 5*StdDev]$
 - Repeat 10 times and the resulting standard deviation stabilizes
 - Minimize effect of outliers

DCA_{xy} resolution: iterative StdDev



- Worse than requirement at low p_T and large rapidity

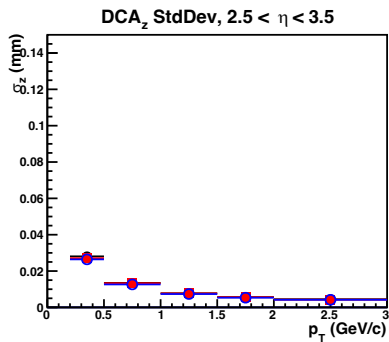
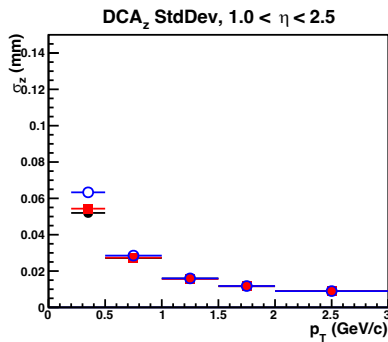
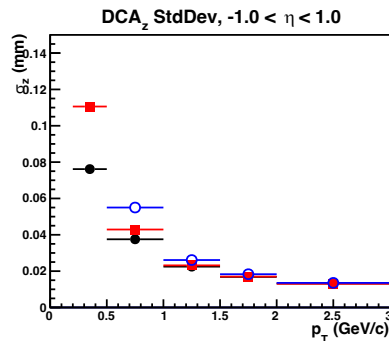
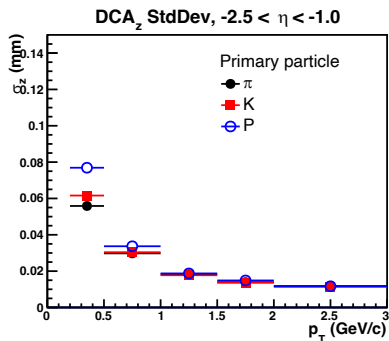
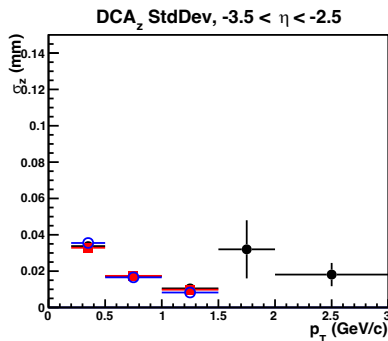
DCA_{xy} resolution: iterative StdDev



RC vertex

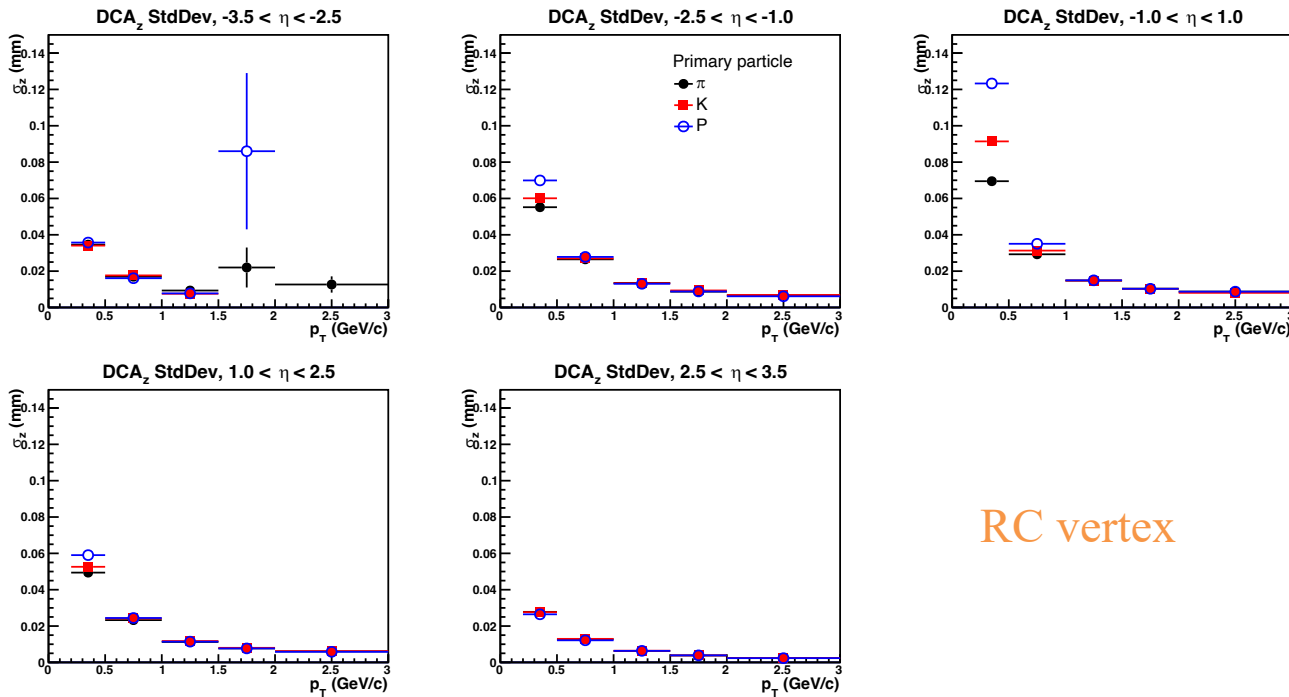
- Slightly “better” resolution compared to using true vertex

DCA_z resolution: iterative StdDev



MC vertex

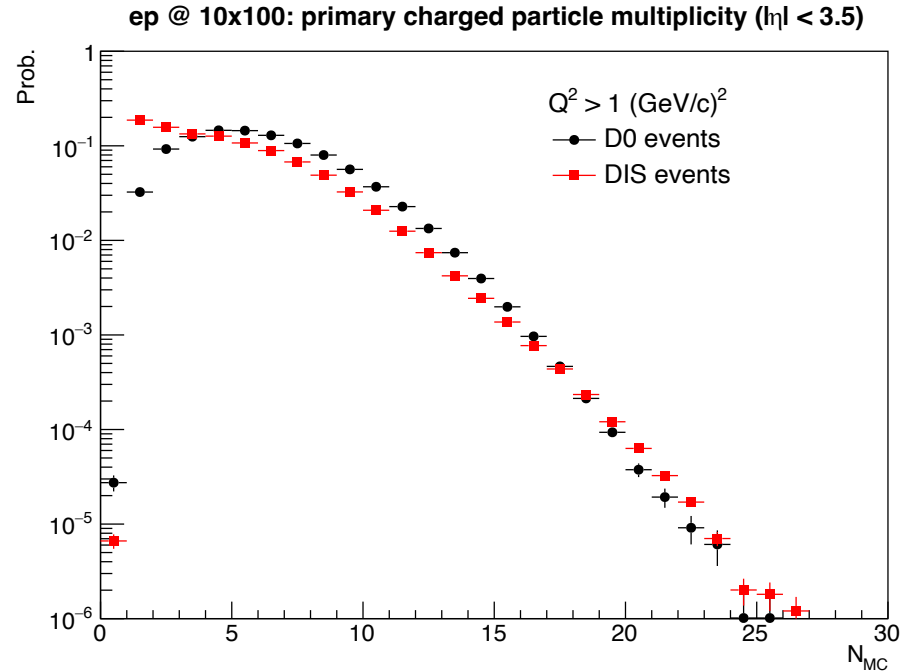
DCA_z resolution: iterative StdDev



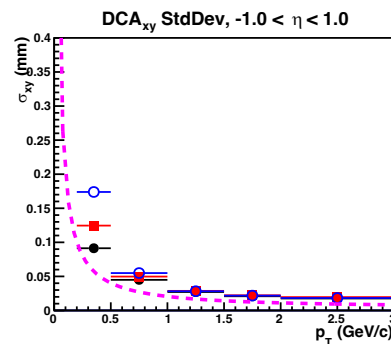
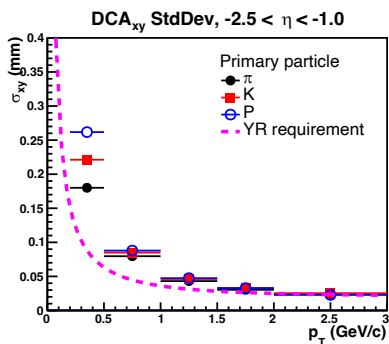
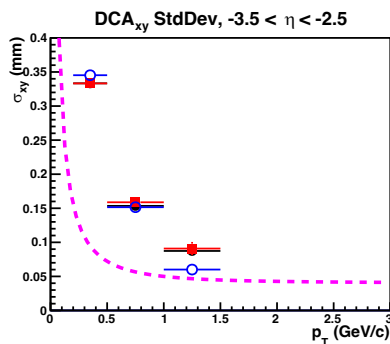
RC vertex

- Slightly “better” resolution compared to using true vertex

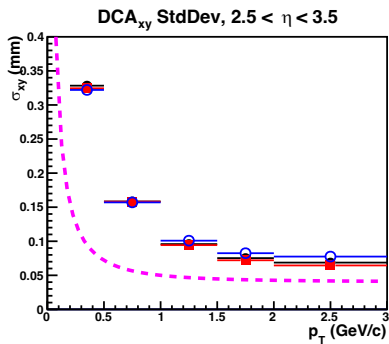
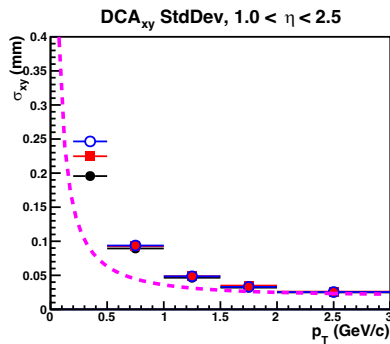
Compare multiplicity distribution



DCA_{xy} resolution: iterative StdDev

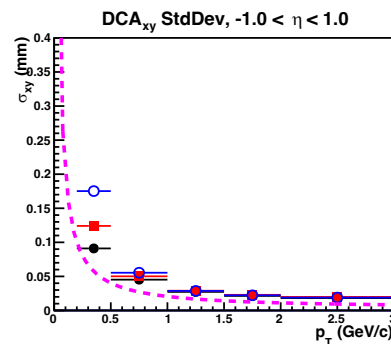
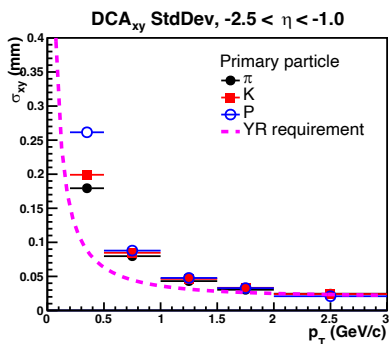
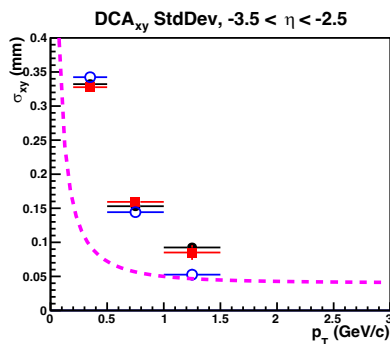


$N_{MC} \geq 0$

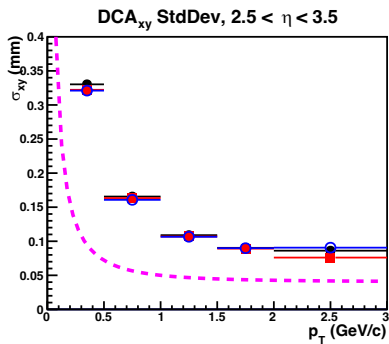
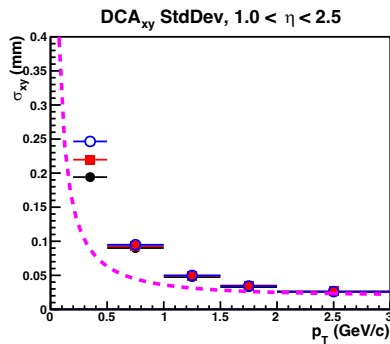


RC vertex

DCA_{xy} resolution: iterative StdDev

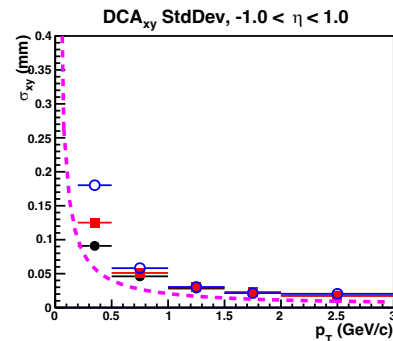
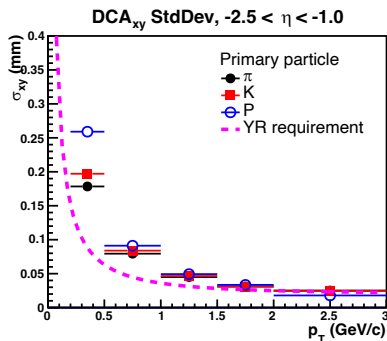
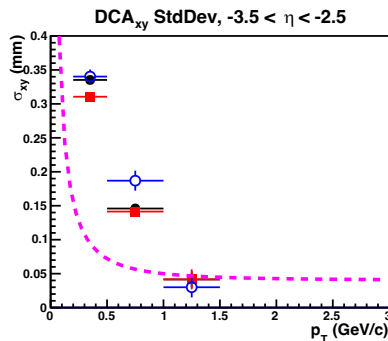


$N_{MC} \geq 5$

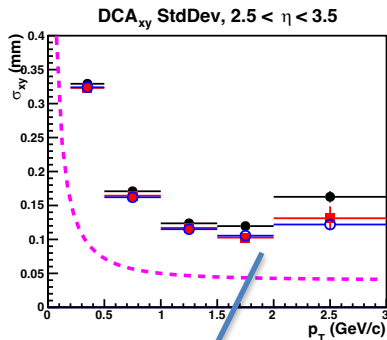
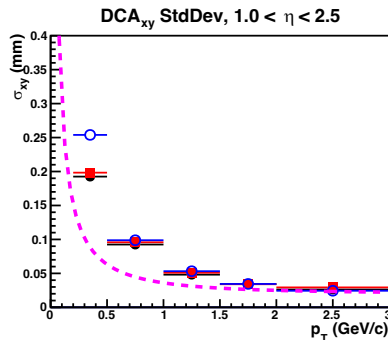


RC vertex

DCA_{xy} resolution: iterative StdDev



$N_{MC} \geq 10$



RC vertex

- Running out of statistics

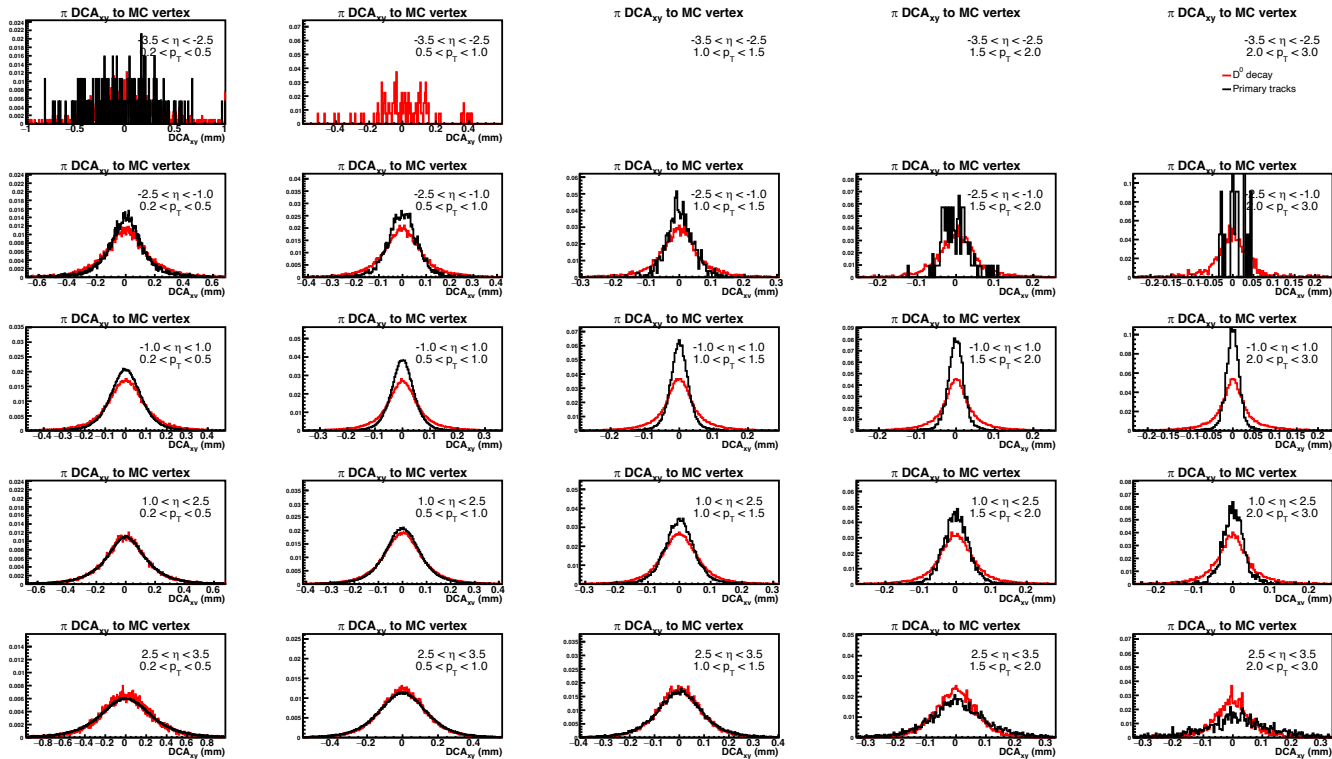
Primary vs. secondary tracks

Analysis setup

- Simulation sample
 - D0 events
 - ep @ 10x100
 - $Q^2 > 1 \text{ (GeV/c)}^2$
 - Simulation campaign: 25.04.1
- Track selection
 - Primary vs. secondary tracks
 - Truth PID

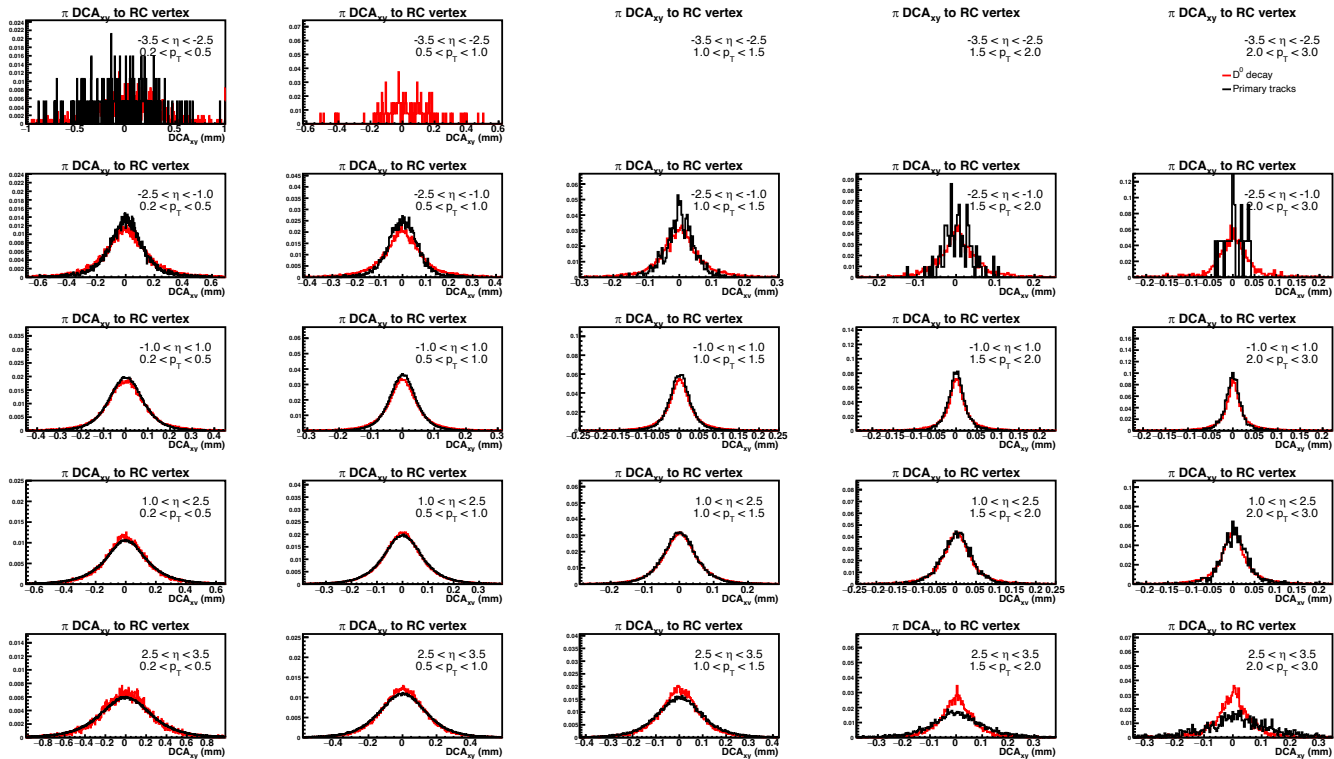
π DCA_{xy}

MC vertex



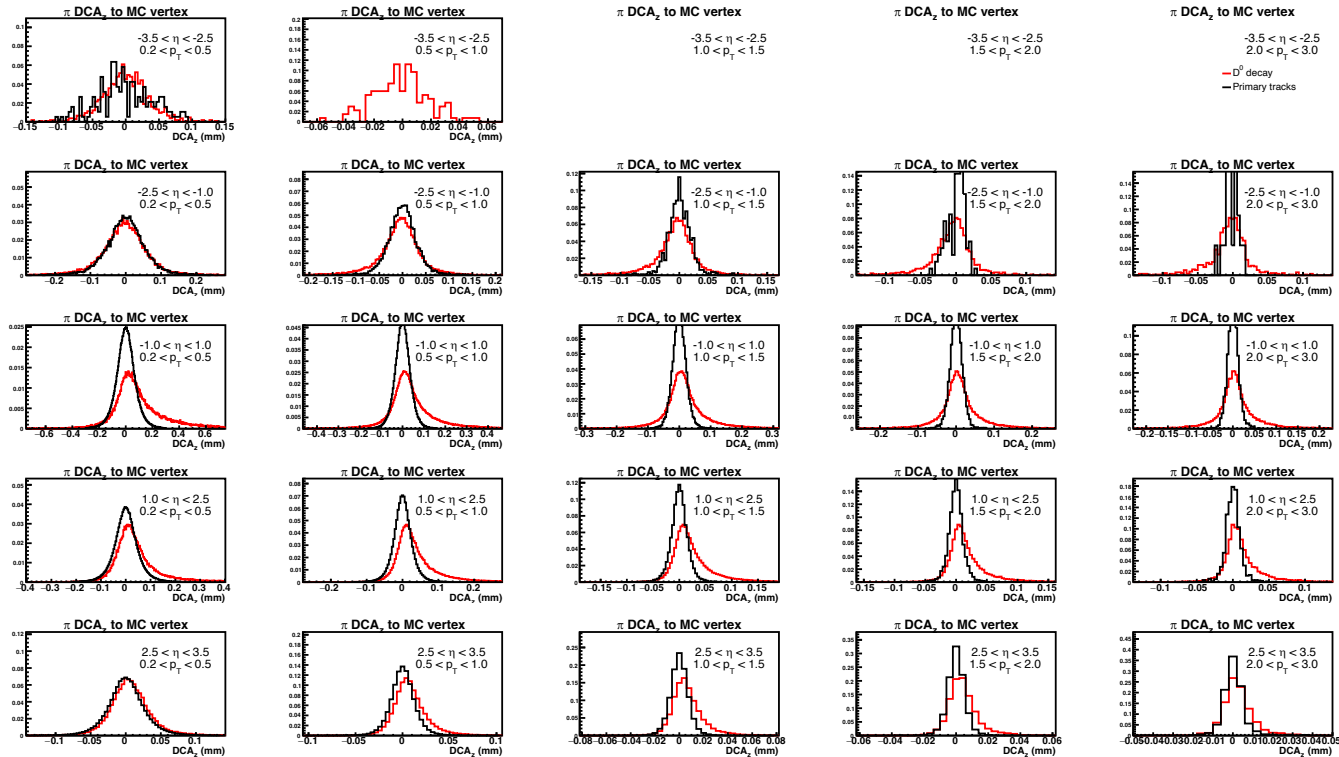
π DCA_{xy}

RC vertex



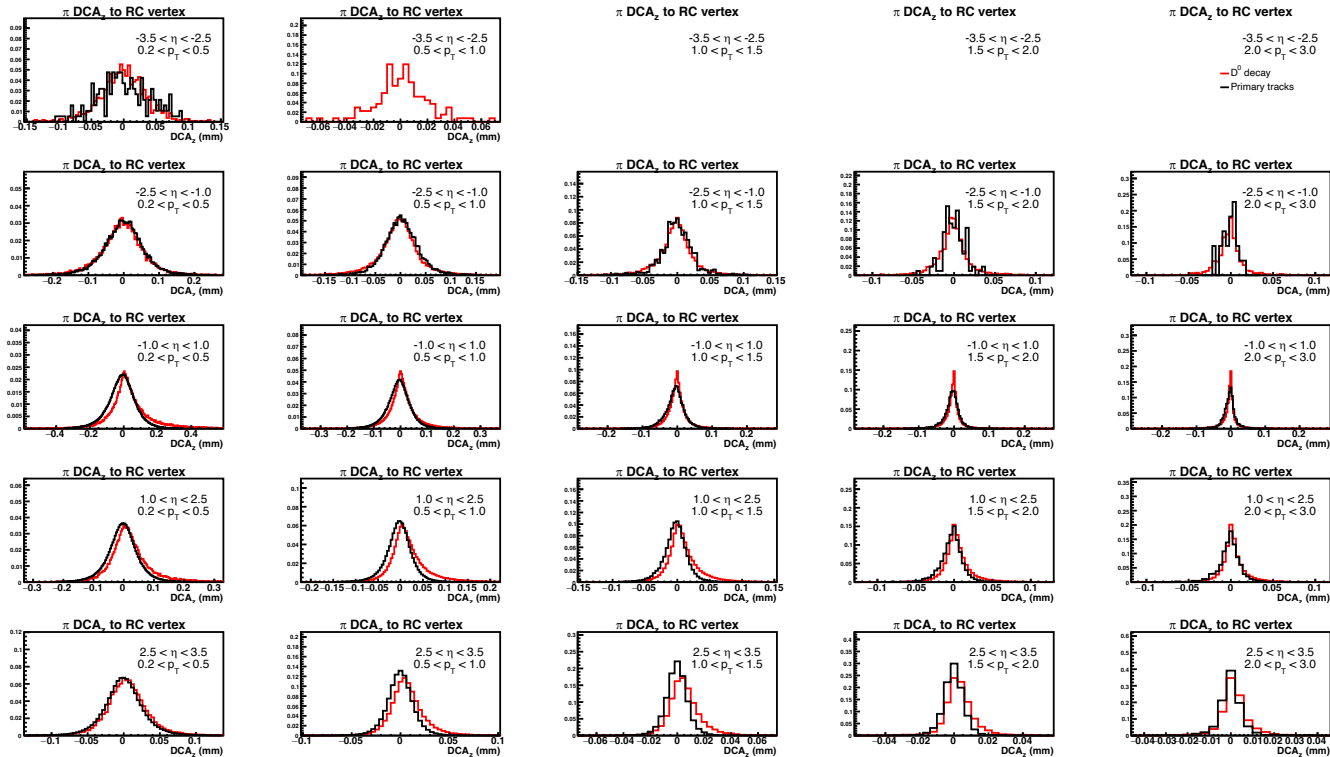
π DCA_z

MC vertex



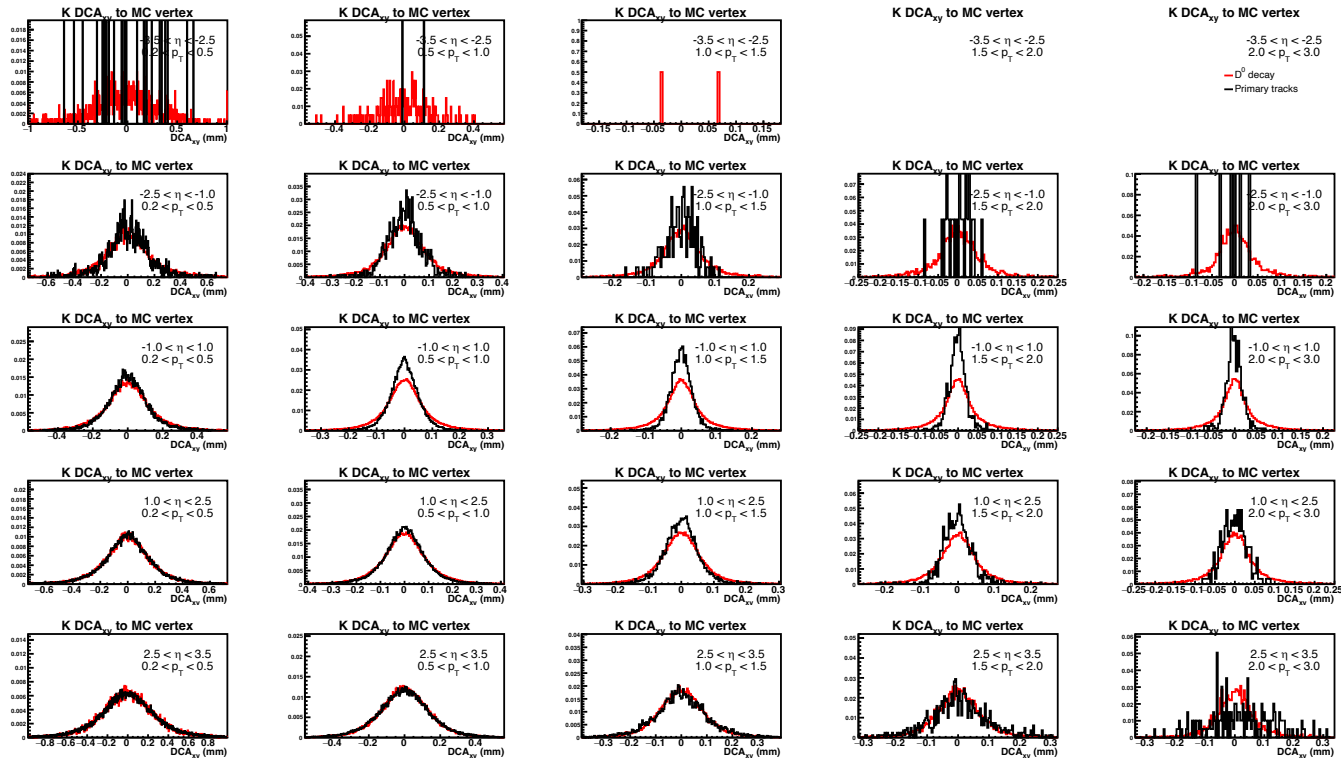
π DCA_z

RC vertex



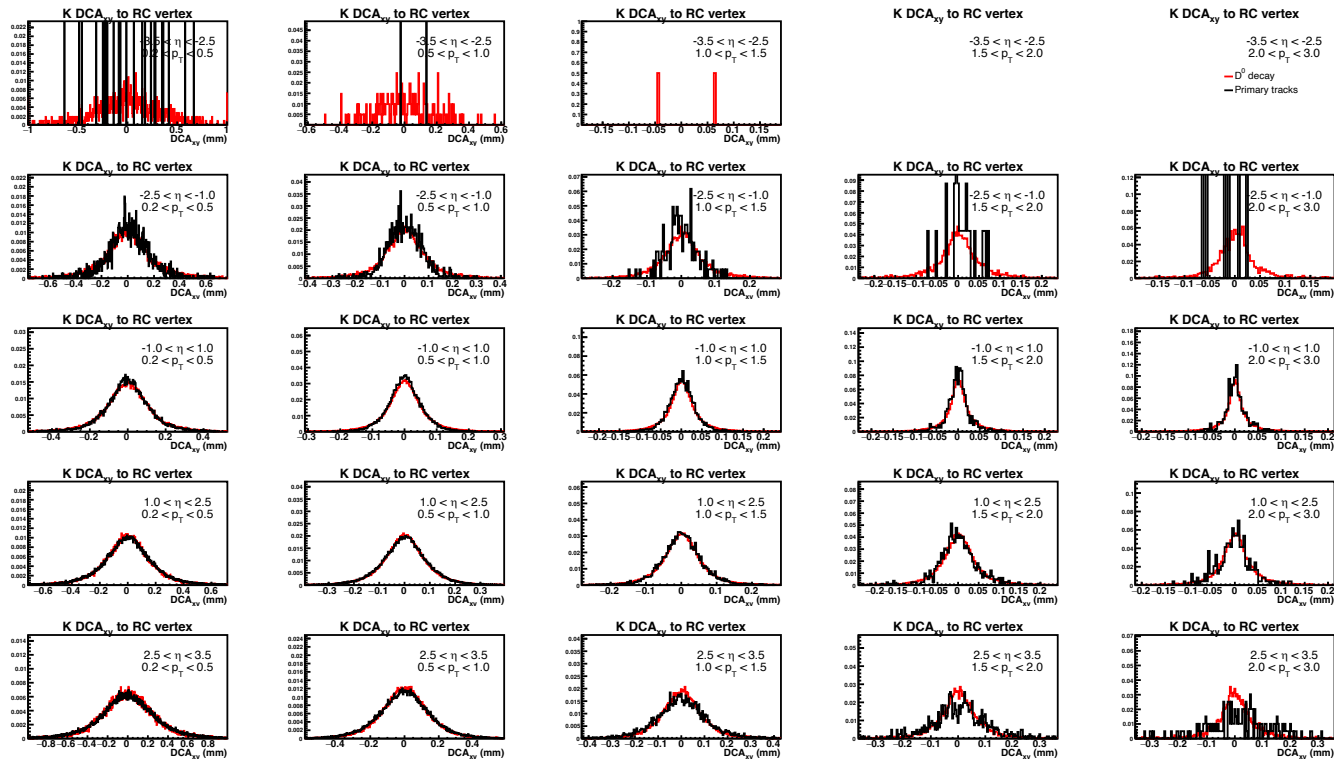
Kaon DCA_{xy}

MC vertex



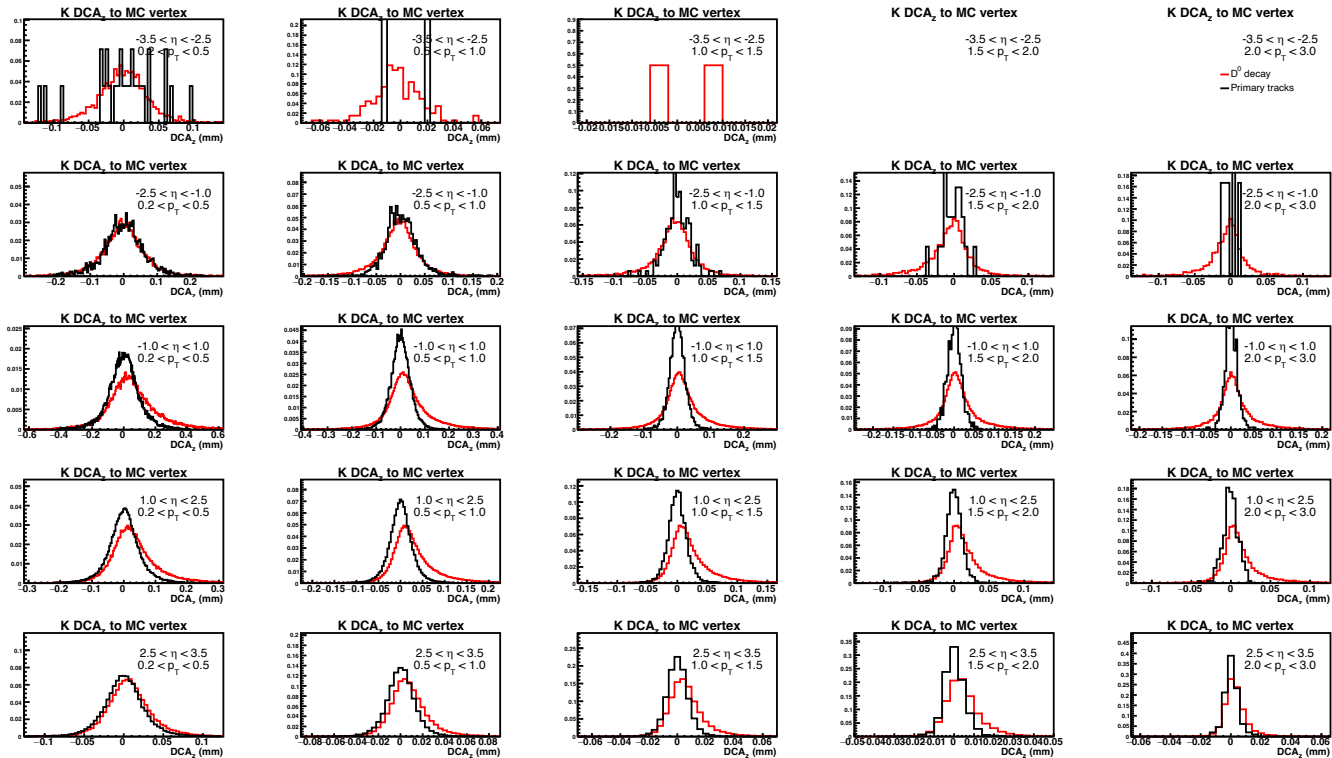
Kaon DCA_{xy}

RC vertex



Kaon DCA_z

MC vertex



π DCA_z

RC vertex

