

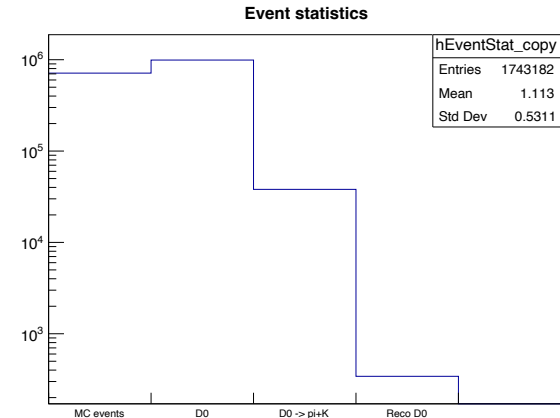
D0 reconstruction in DIS events

Rongrong Ma

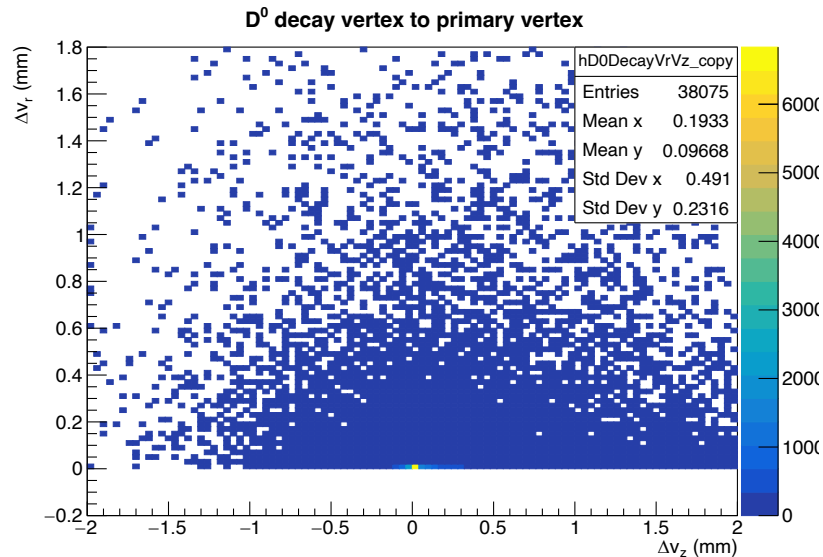
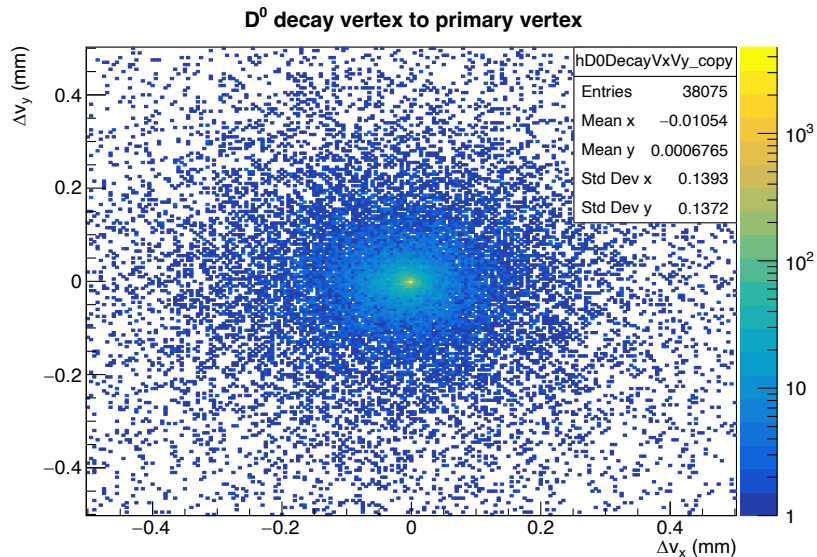
10/17/2024

Analysis setup

- PYTHIA 8.306 ep@18x275, NC, $Q^2_{\min} = 100$
- With beam effects
- D^0 -enriched sample: each event contains at least one D^0 or anti- D^0
- Select events with D^0 or anti- D^0 that decays into $\pi + K$
 - Branching ratio: $(3.947 \pm 0.030)\%$
- EIC geometry: *epic-24.09.0*
- EICrecon: **default realistic seeding**



D⁰ decay vertex w.r.t. primary vertex

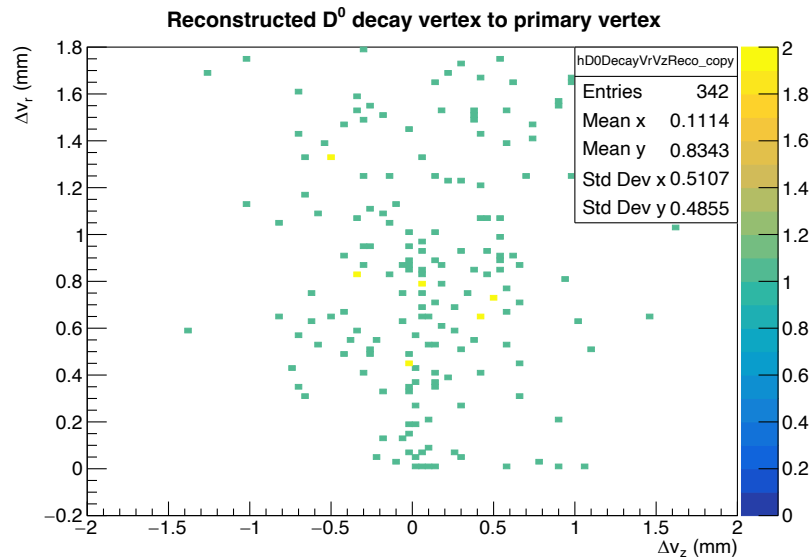
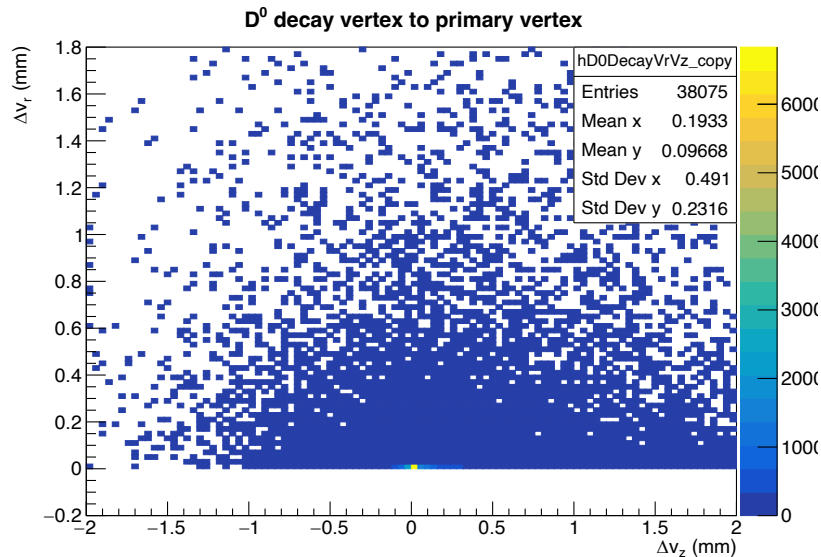


- MC information

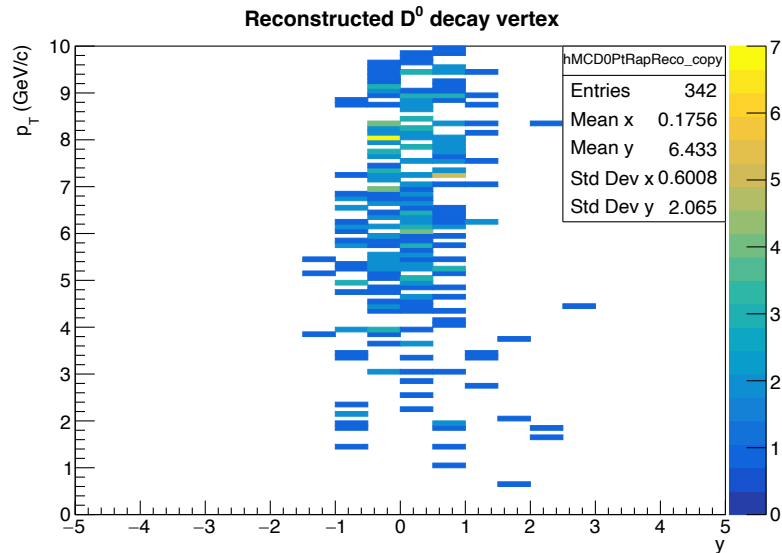
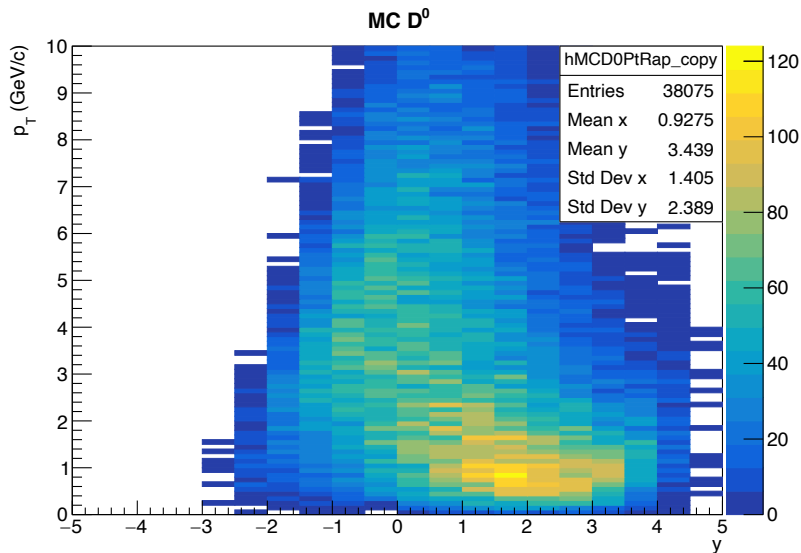
D^0 reconstruction in IterativeVertexFinder

- If a vertex is reconstructed solely out of D^0 decay daughters, the D^0 decay vertex is considered reconstructed

D⁰ decay reconstruction

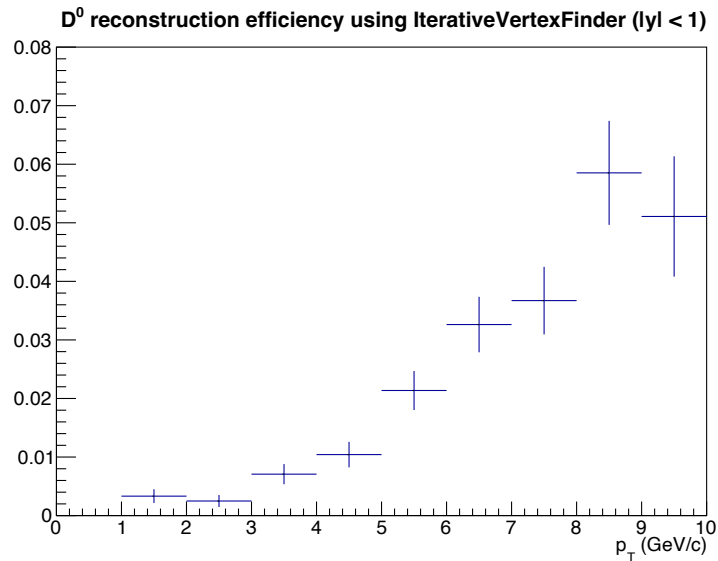


D⁰ decay reconstruction



- Inclusive reconstruction efficiency $\sim 1\%$

D⁰ reconstruction efficiency



D^0 reconstruction based on topology

Distance of Closest Approach (DCA)

- Project each track to reconstructed primary vertex and find its DCA point.
 - Based on the code provided by Barak using ACTS functionality
 - <https://github.com/eic/snippets/tree/main/Tracking/ImpactPointEstimator>
 - *Need to include covariant matrix*
- Check DCA_{xy} and DCA_z distributions
- Should implement them into EICrecon

```
edm4eic::ReconstructedParticle:
```

```
Description: "EIC Reconstructed Particle"
```

```
Author: "W. Armstrong, S. Joosten, F. Gaede"
```

```
Members:
```

- ```
- edm4hep::Vector3f momentum // [GeV] particle momentum. Four momentum state is not kept consistent internally.
- edm4hep::Vector3f referencePoint // [mm] reference, i.e. where the particle has been measured
```

```
edm4eic::Track:
```

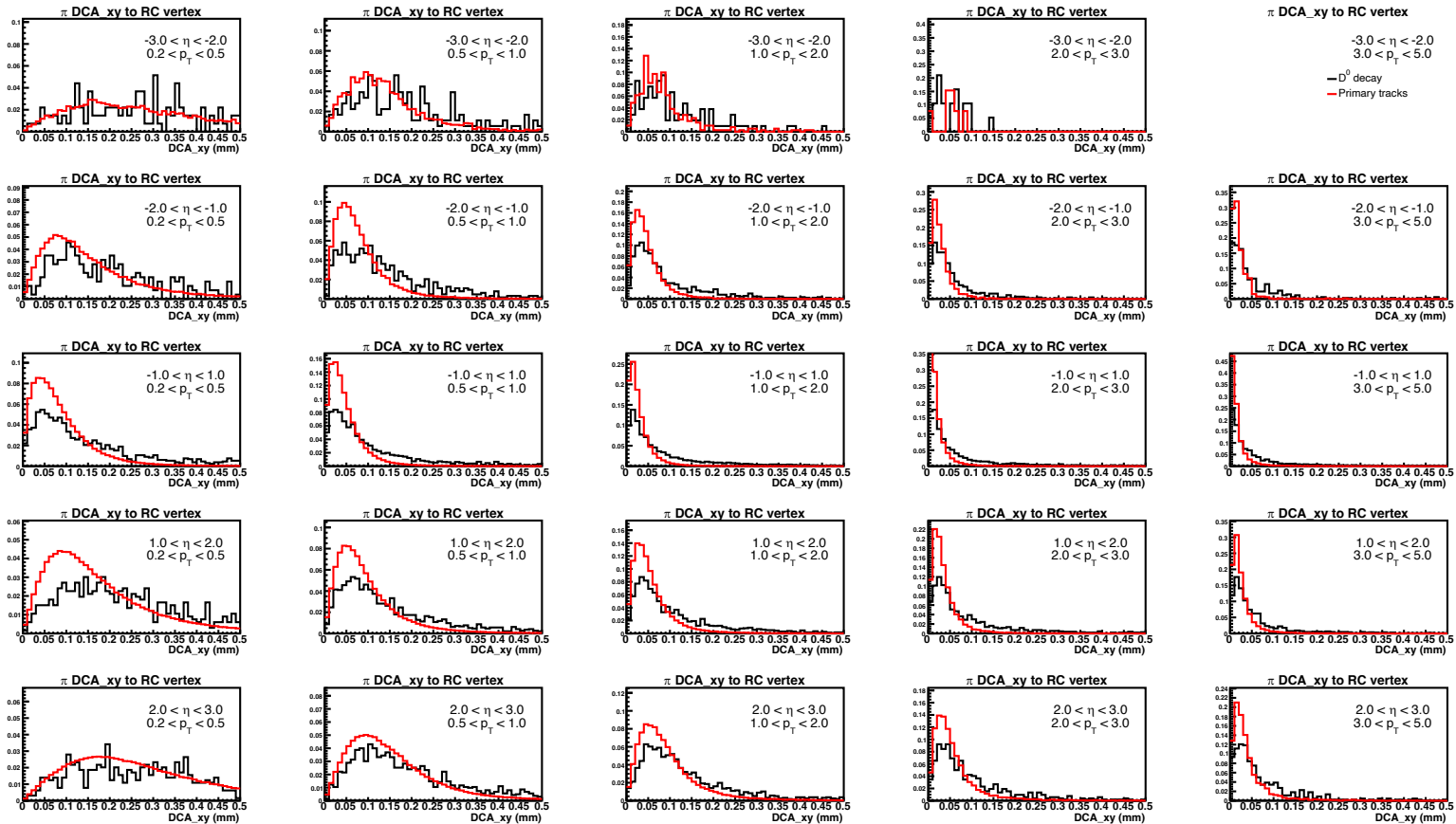
```
Description: "Track information at the vertex"
```

```
Author: "S. Joosten, J. Osborn"
```

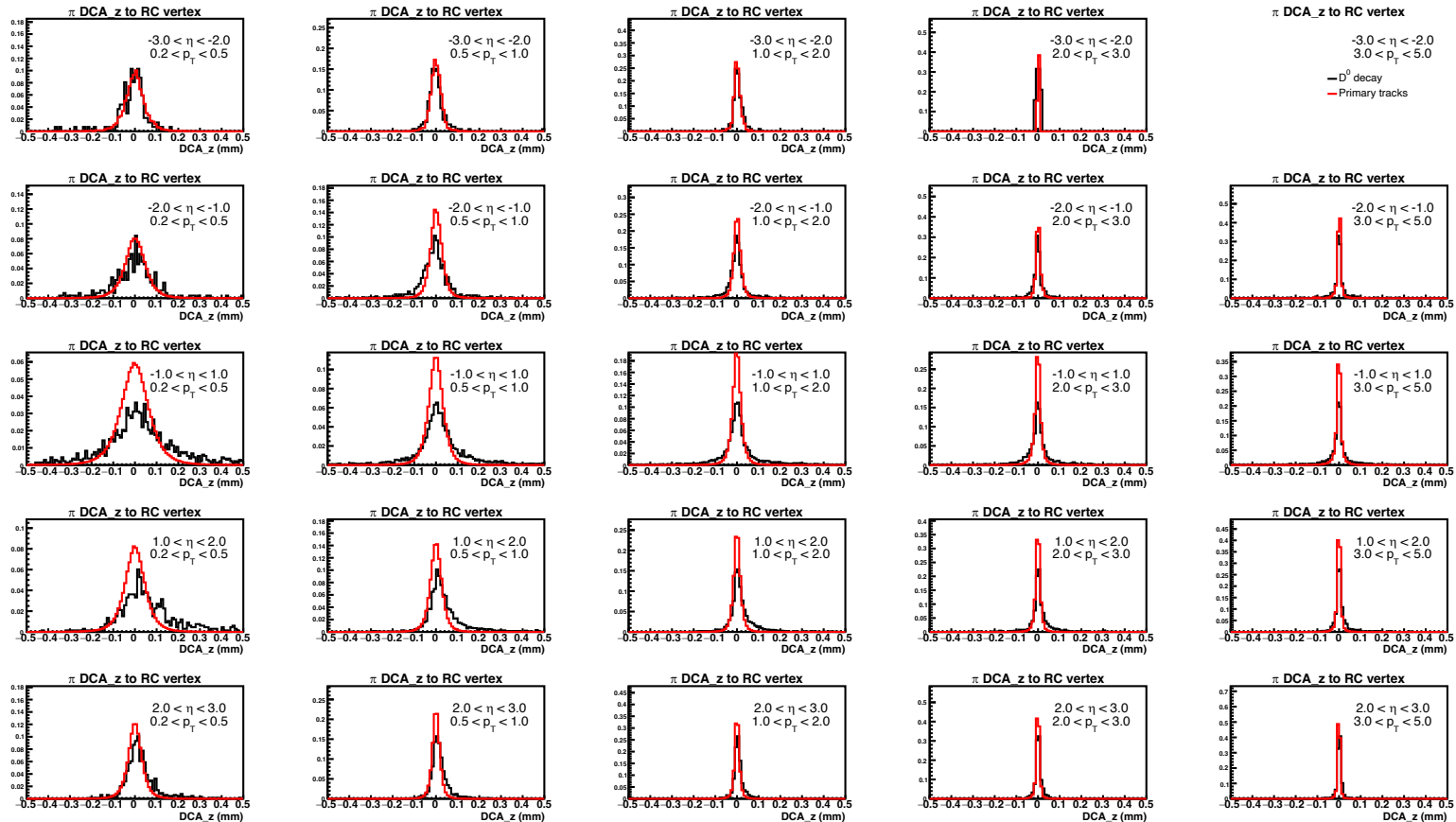
```
Members:
```

- ```
- int32_t          type           // Flag that defines the type of track  
- edm4hep::Vector3f position      // Track 3-position at the vertex  
- edm4hep::Vector3f momentum     // Track 3-momentum at the vertex [GeV]
```

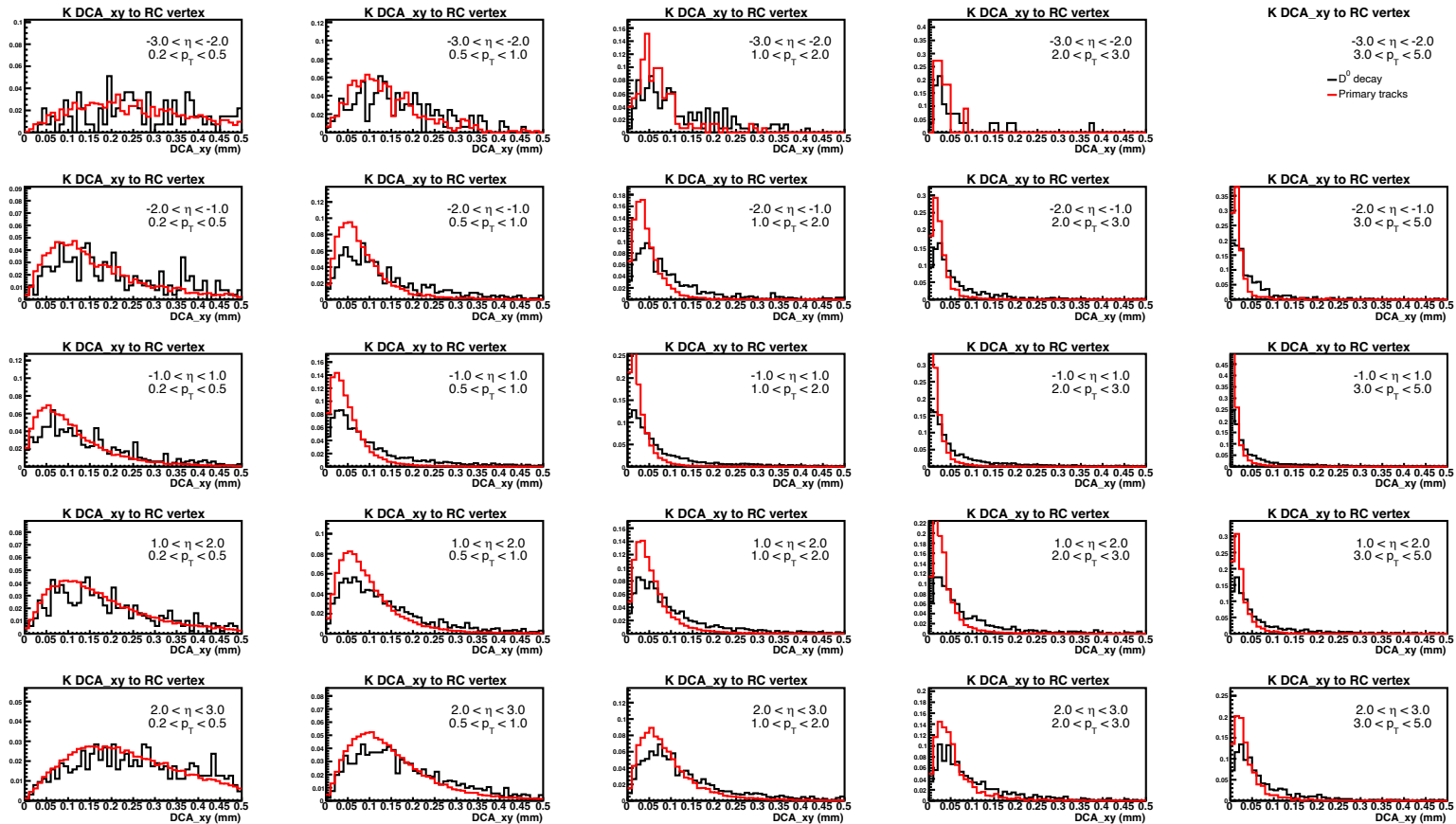
DCA_{xy} for pion: primary vs. secondary



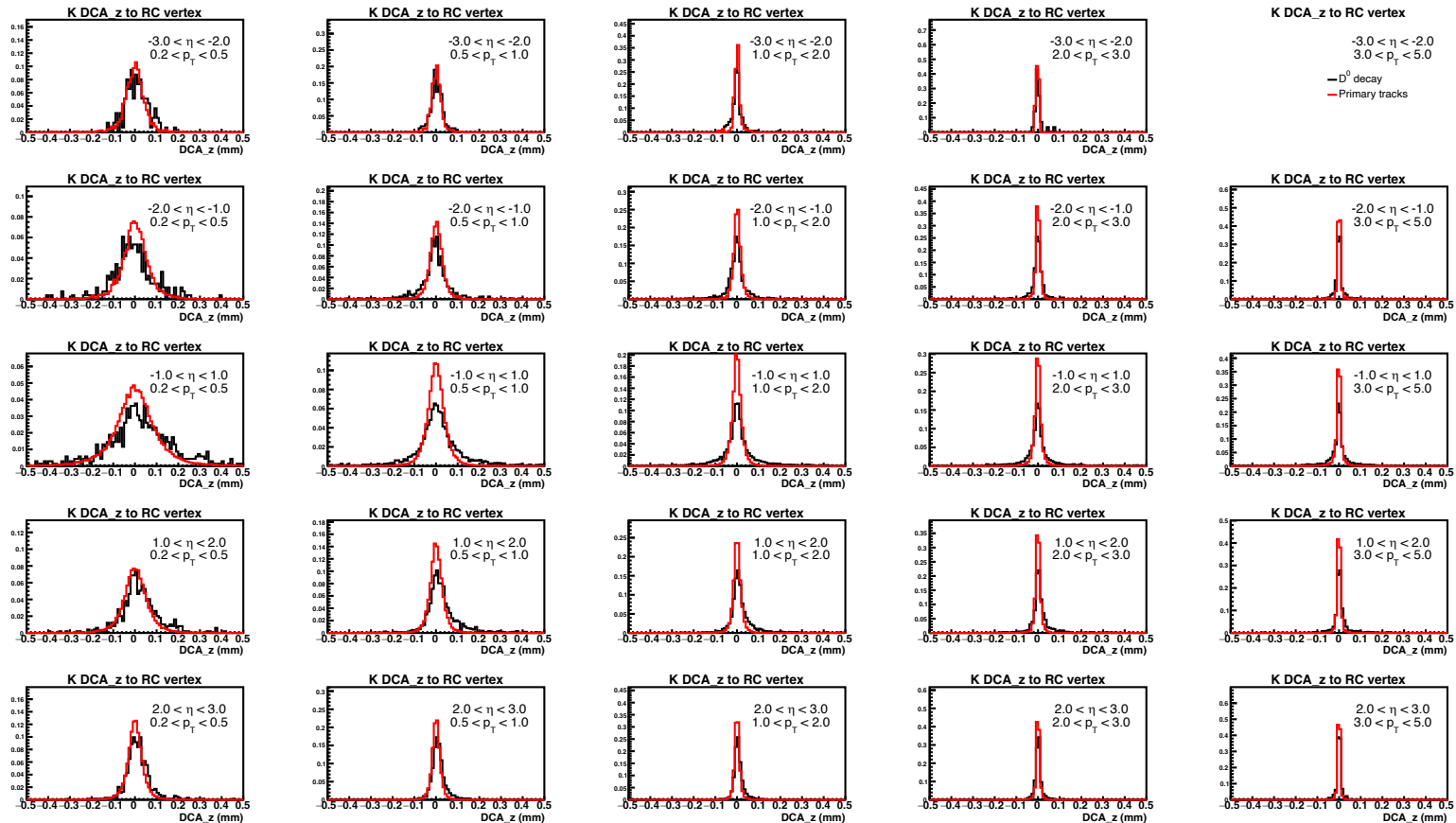
DCA_z for pion: primary vs. secondary



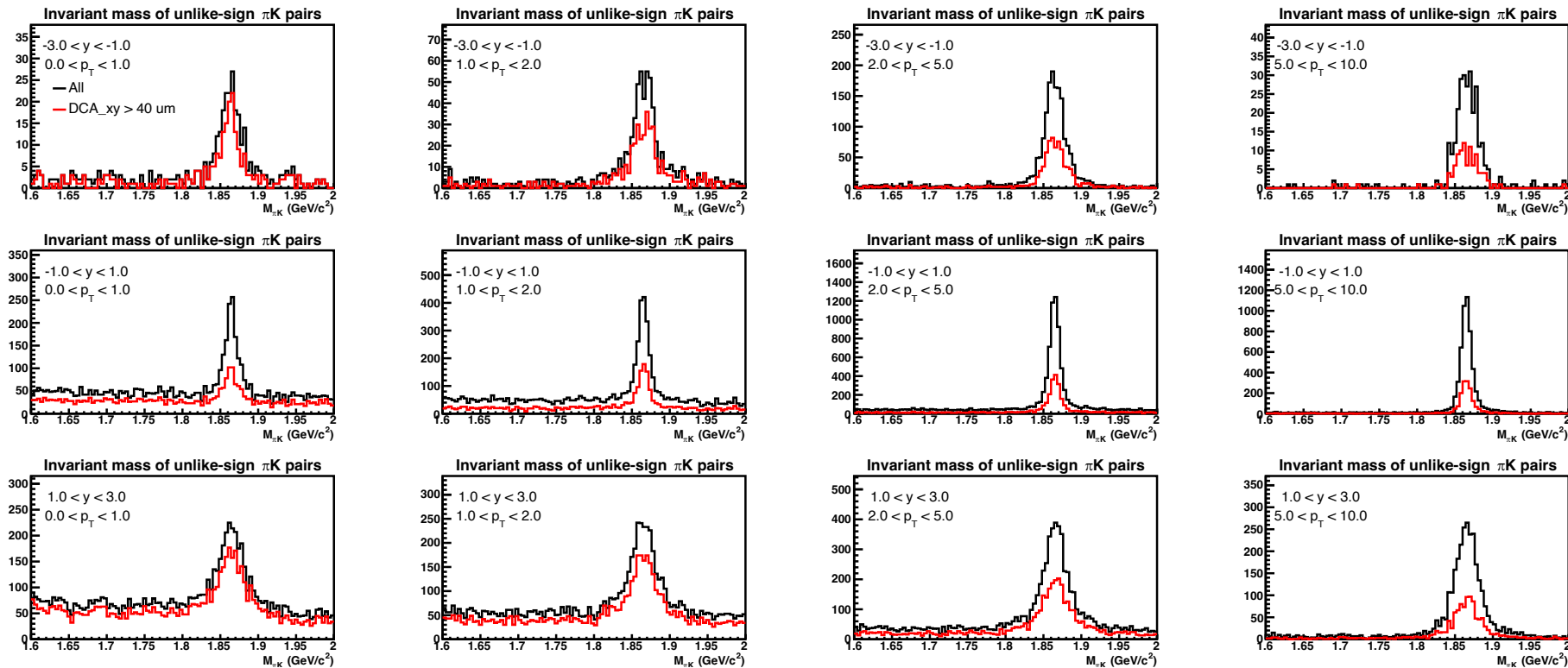
DCA_{xy} for Kaon: primary vs. secondary



DCA_z for Kaon: primary vs. secondary

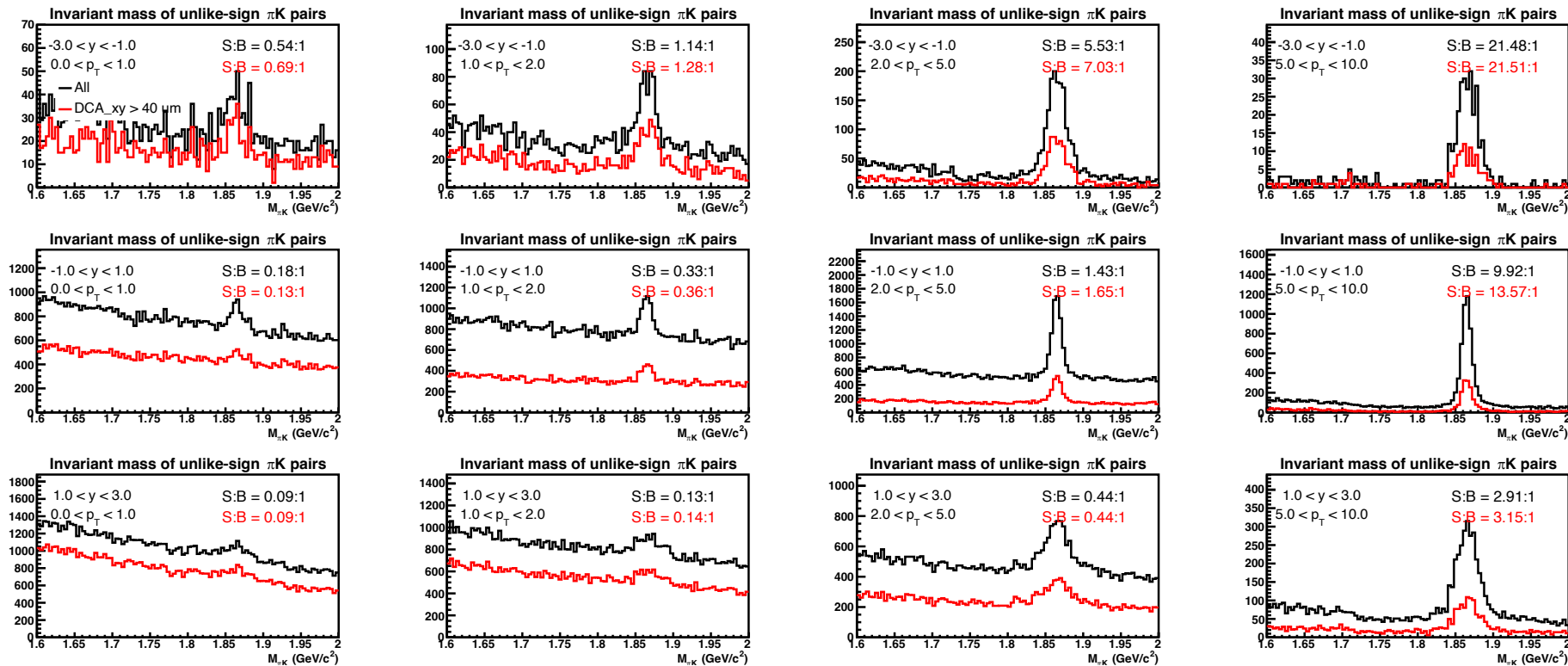


Invariant mass distribution



- Events with $D^0 \rightarrow K + \pi$

Invariant mass distribution



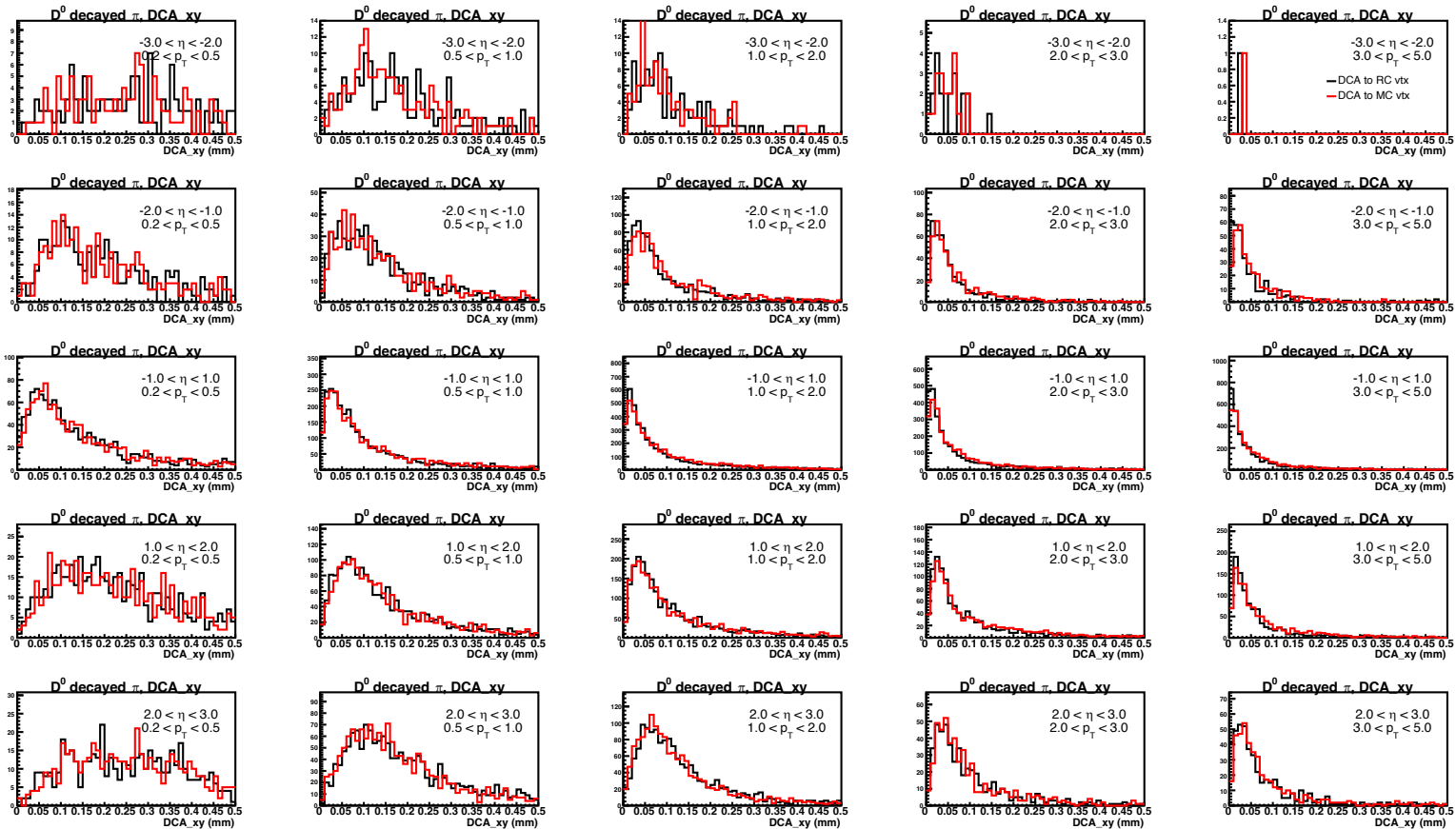
- All events with D^0 . S/B ratio within 2σ of mass peak.
- Background should be a factor of 9 higher with DIS events

Next

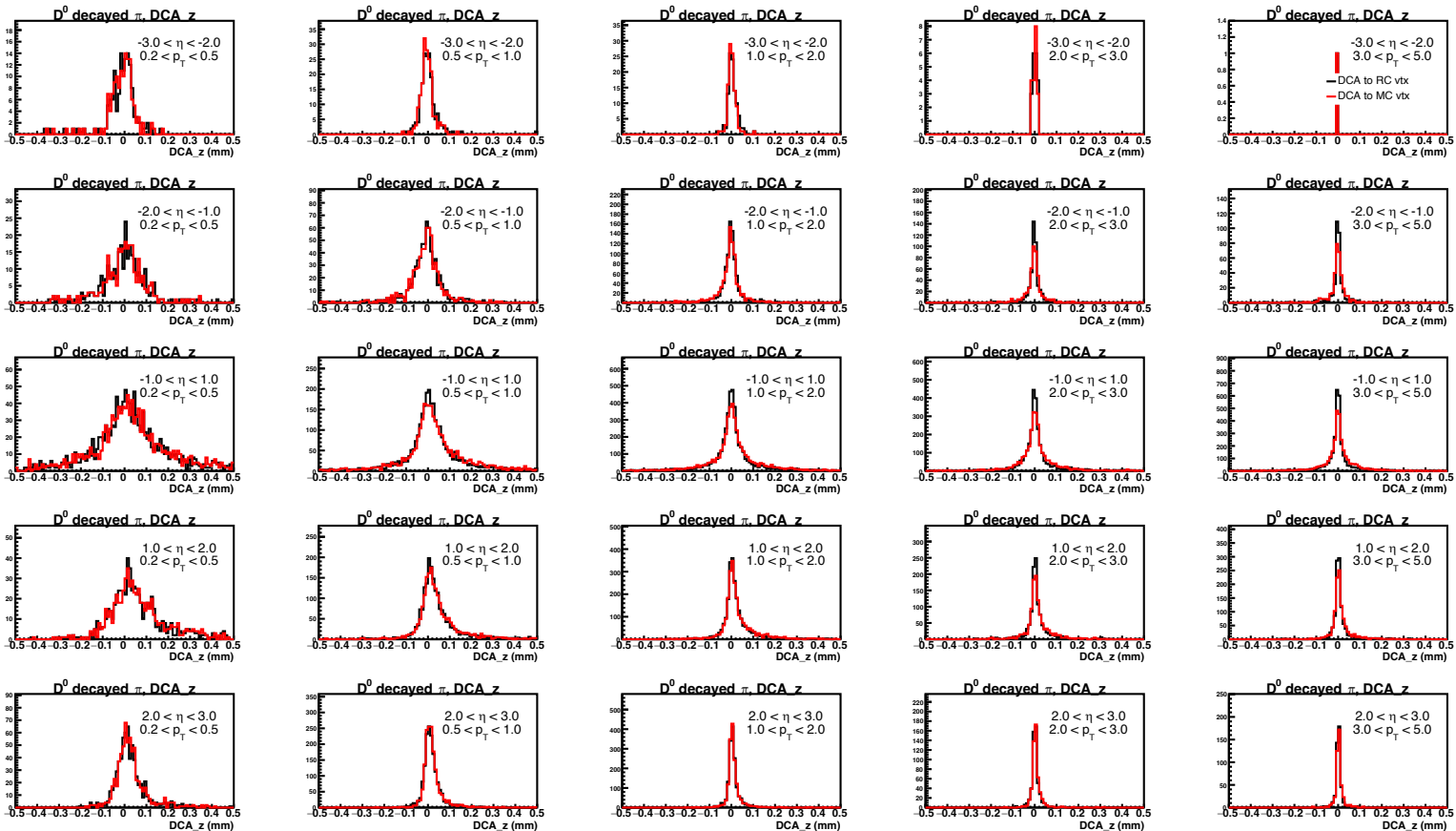
- DCA between daughter tracks to enable more topological selections
- Other approaches
 - Secondary vertexing
 - KFParticle

Backup

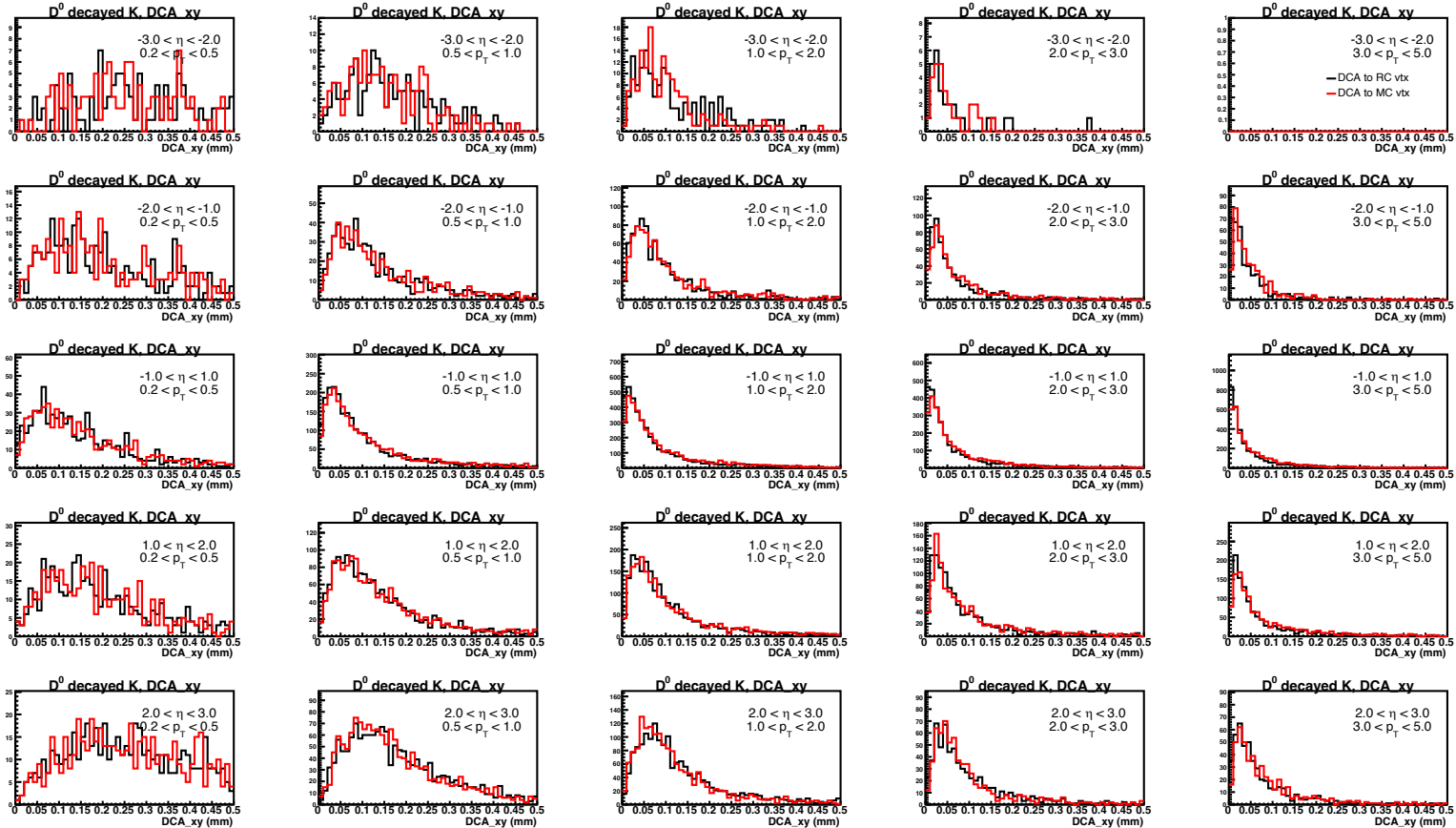
DCA_{xy} for D⁰ decayed pion



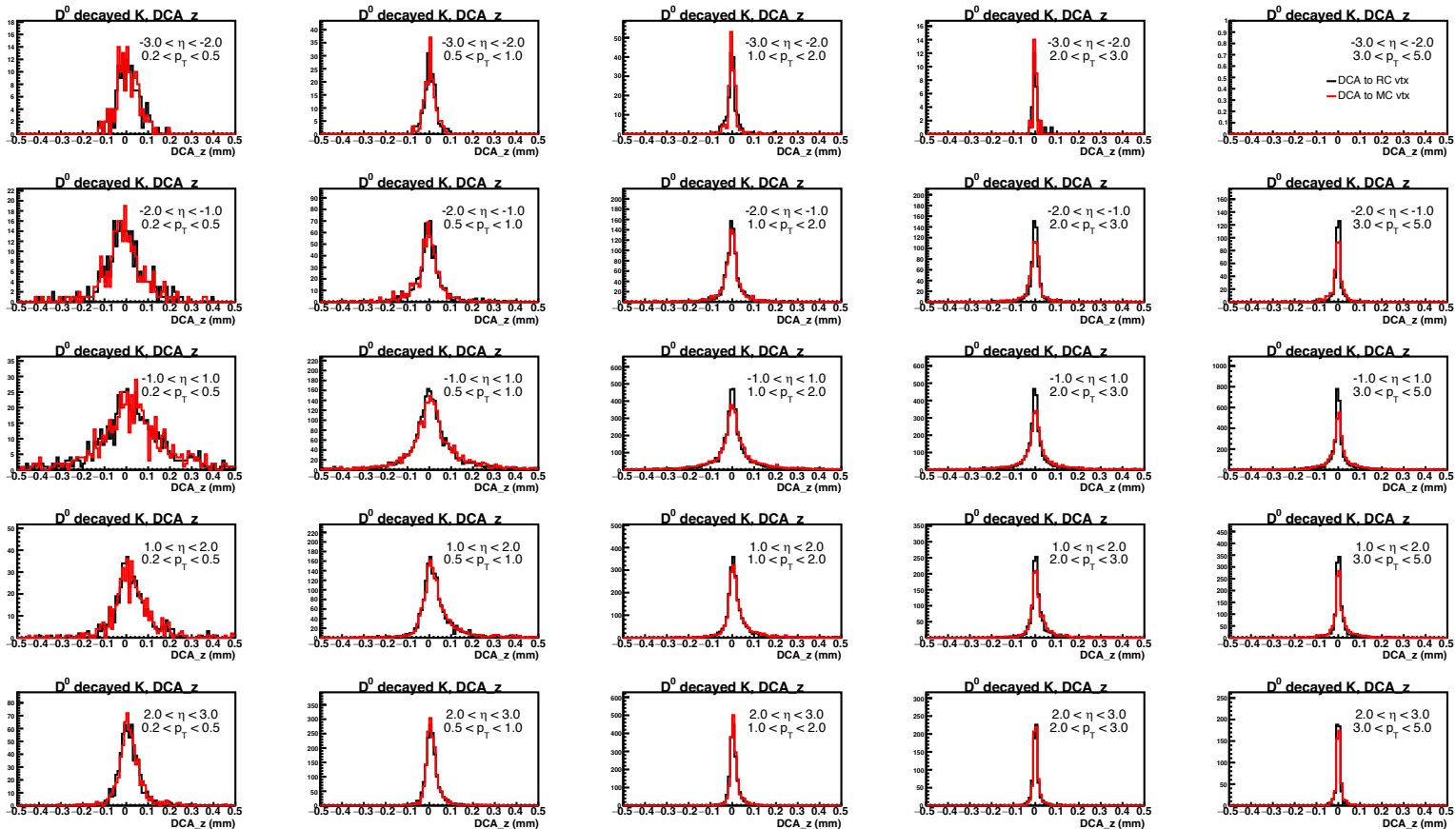
DCA_z for D⁰ decayed pion



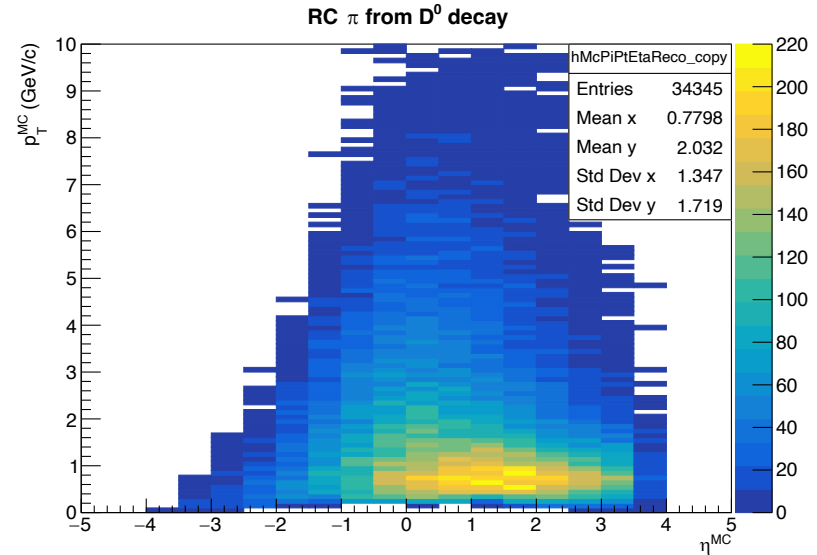
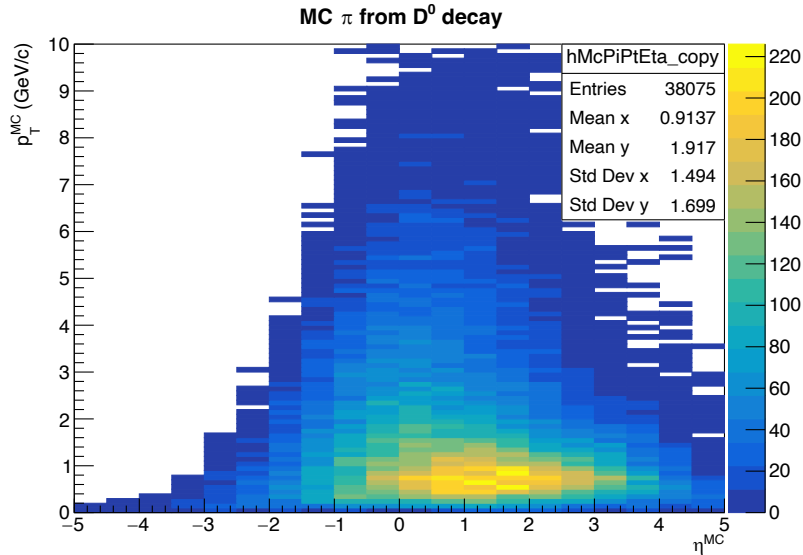
DCA_{xy} for D⁰ decayed Kaon



DCA_z for D⁰ decayed Kaon



D⁰ decayed pion



D⁰ decayed Kaon

