

D^0 Reconstruction

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Source of Files

DIS:

```
root://dtn-eic.jlab.org//work/eic2/EPIC/REC0/25.03.1  
/epic_craterlake/DIS/NC/18x275/minQ2=10/
```

	N J/Psi	Lumi fb ⁻¹	J/Psi xsec fb	B ⁺	B ⁺ xsec	D ⁰	D ⁰ xsec
Q2>1	18	6.73E-03	2.67E+03	259	3.85E+04	97211	1.44E+07
Q2>10	159	7.21E-02	2.21E+03	2981	4.13E+04	321898	4.46E+06
Q2>100	942	1.48E+00	6.36E+02	16180	1.09E+04	284700	1.92E+05
Q3>1000	521	6.30E+01	8.27E+00	9062	1.44E+02	131395	2.09E+03
0<Q2<1	32844	9.26E-04	3.55E+07	1564	1.69E+06	442885	4.78E+08

Ralf's Slides

Motivation and Reconstruction Strategy

Why $D^0 \rightarrow K^- \pi^+$?

- Clean decay channel with well-known BR $\sim 3.9\%$
- Allows access to charm quark production
- Probe gluon Sivers effect via charm

Reconstruction Workflow

- Reconstruct charged particles
- Associate Reco MC particles
- **Note:** Reconstructed was inconsistent, so was recalculated using
$$E = \sqrt{\vec{p}^2 + m^2}$$

Truth Matching and Selection

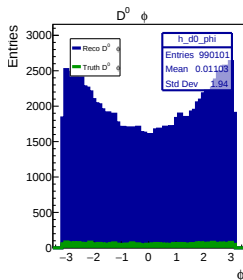
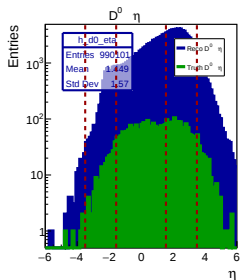
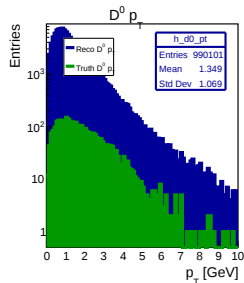
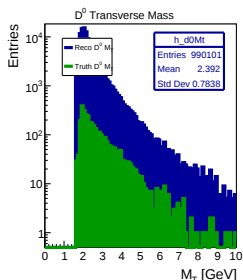
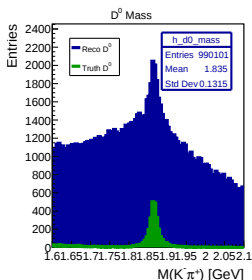
MC Truth Matching

- Use `ReconstructedChargedParticleAssociations` to map reconstructed tracks to `MCParticles`
- Verify that each track's MC parent is a D^0 (PDG = 421)
- Recursive ancestry check to trace back to D^0 origin

Candidate Selection Criteria

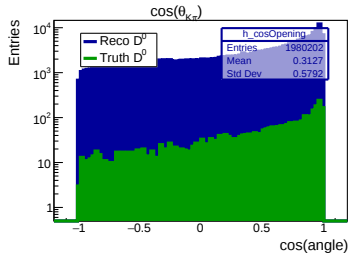
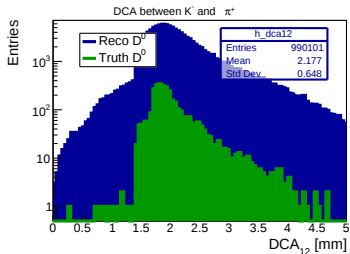
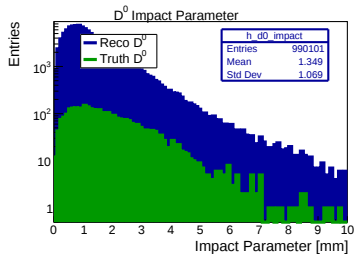
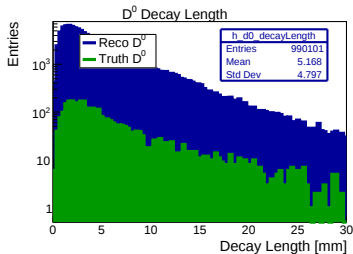
- Require one kaon (K^-) and one pion (π^+) per candidate
- Apply kinematic cuts: $W > 5 \text{ GeV}$, $Q^2 > 1 \text{ GeV}^2$, $0.1 < y < 0.9$
- Kinematic variables taken from the `InclusiveKinematicsElectron` branch

Reconstructed D^0 Mass and Kinematics

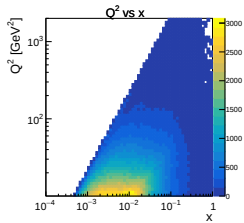
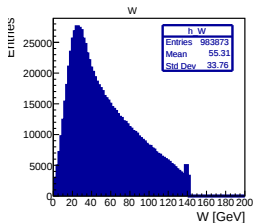
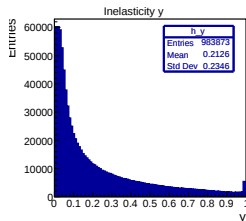
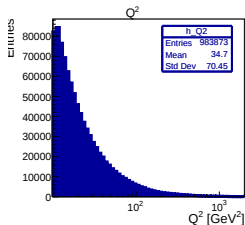
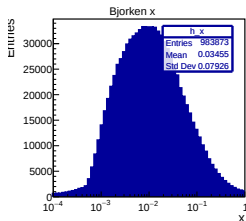


η regions:
-3.5, -1.56, 1.56, 3.5

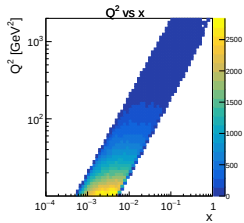
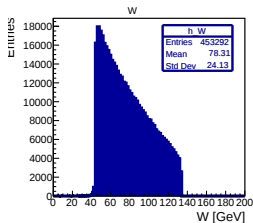
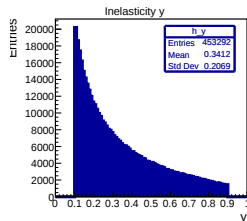
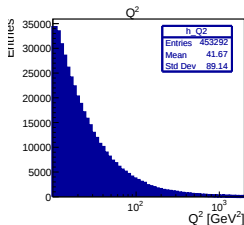
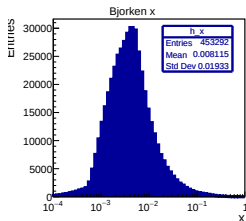
D^0 Decay Geometry



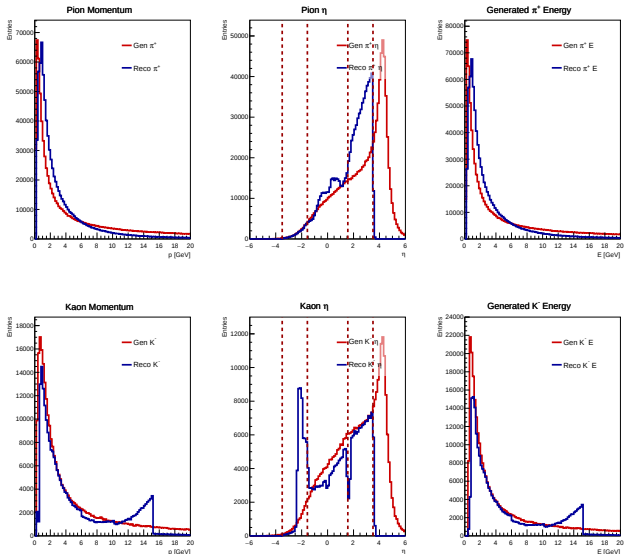
Kinematic Distributions (Before Cuts)



Kinematic Distributions (After Cuts)



Generated vs Reconstructed Pion/Kaon Distributions (Before DIS cuts)



Generated vs Reconstructed Pion/Kaon Distributions (After DIS cuts)

