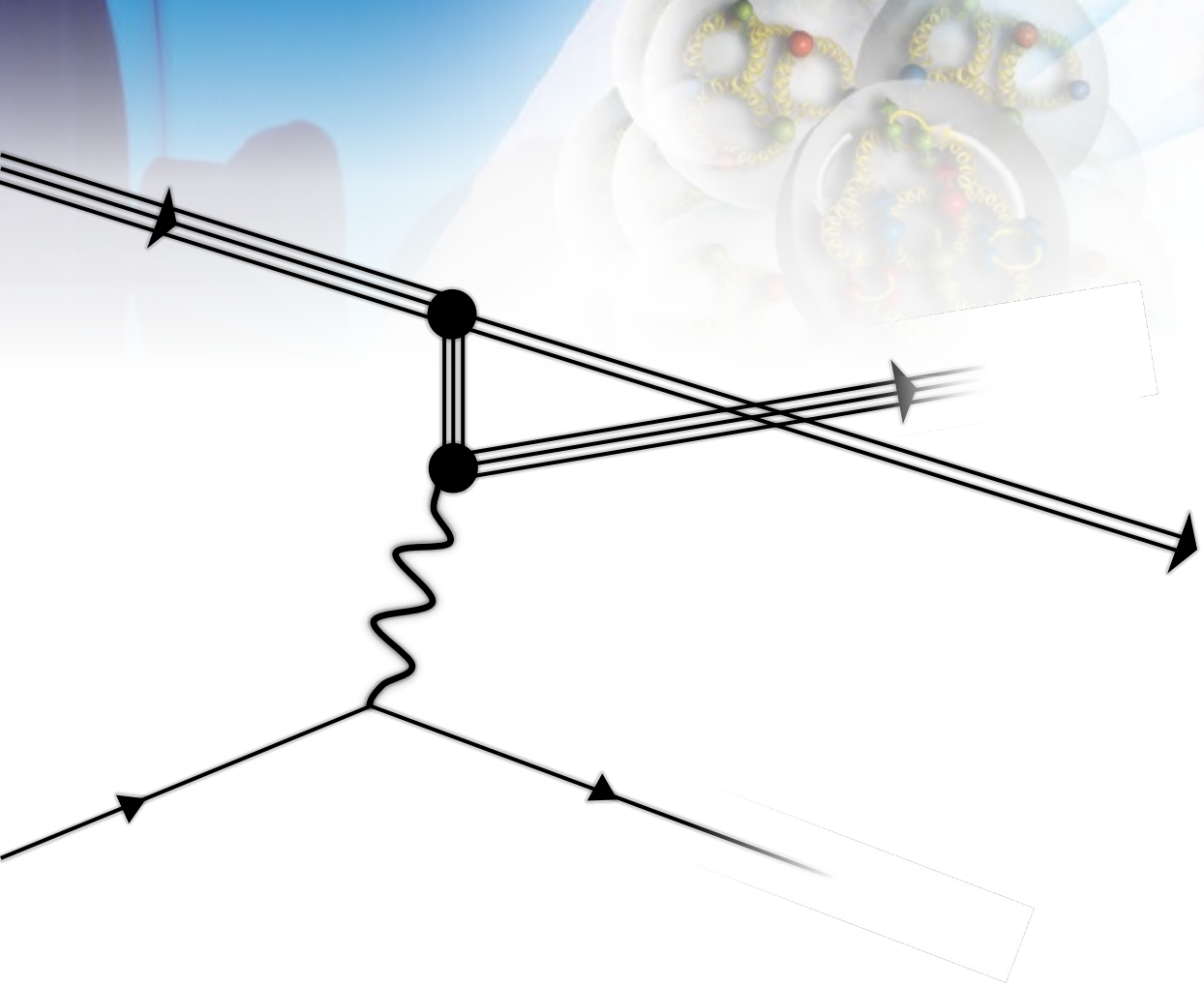
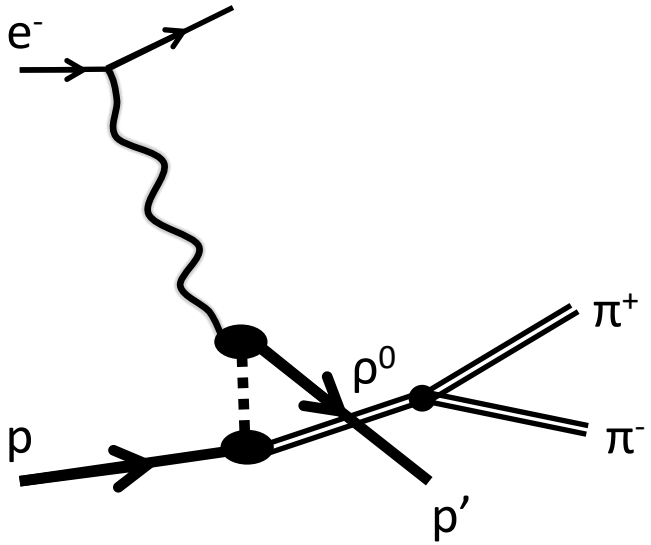


Evaluating B0 Reconstruction with *u*-channel $\rho^0 \rightarrow \pi^+\pi^-$ production

Zachary Sweger
University of California, Davis

Supported in part by

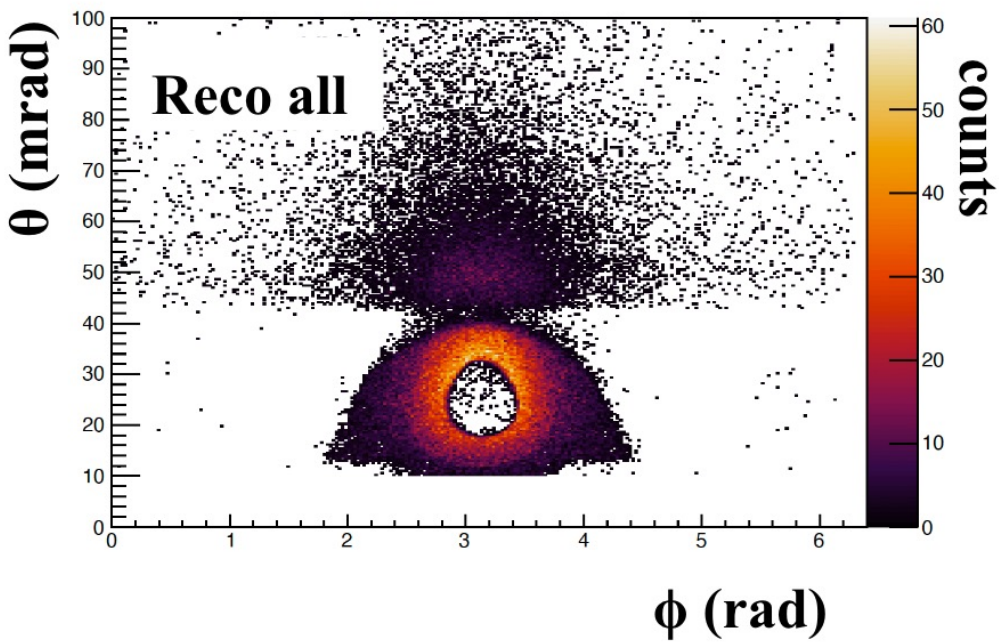
u-channel $\rho^0 \rightarrow \pi^+\pi^-$ in B0

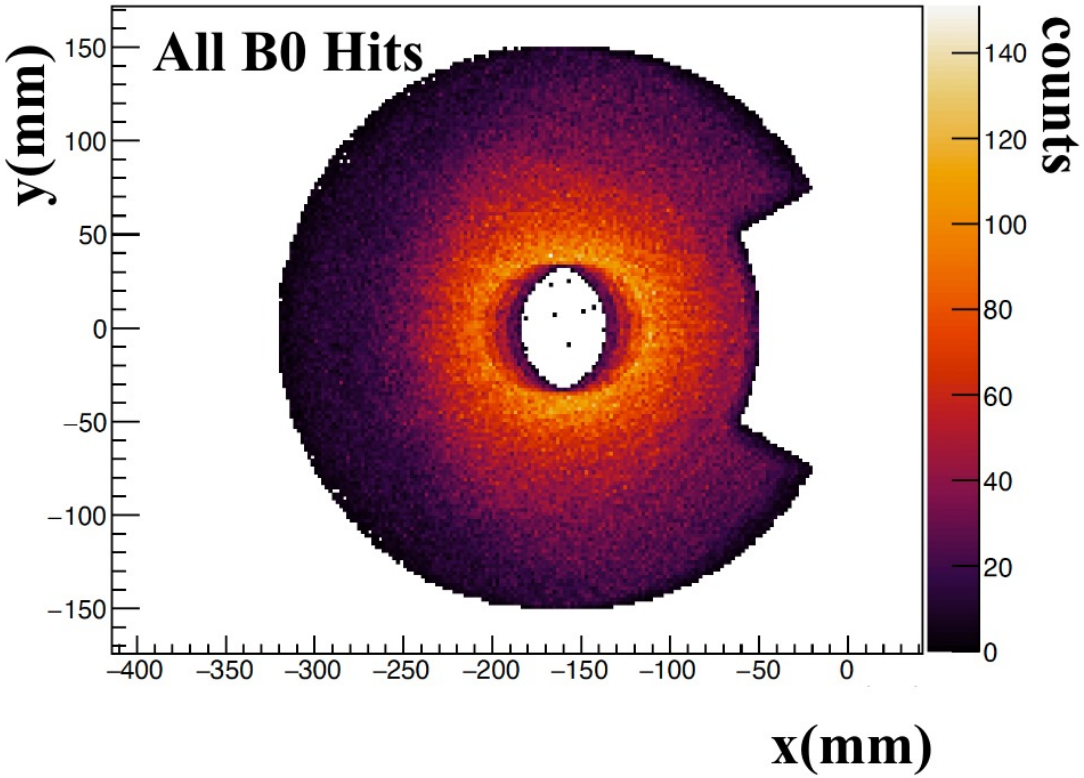


- We developed model for backward ρ production
- Edited eSTARlight to produce this channel
- Made event samples for the simulation campaigns
- These samples are now run in each campaign and can be found on S3:
  - eictest/EPIC/RECO/24.05.0/epic_craterlake/EXCLUSIVE/UCHANNEL_RHO/10x100
- These charged pions land in the B0

u-channel $\rho^0 \rightarrow \pi^+\pi^-$ in B0

- I plotted angular acceptance of reconstructed tracks



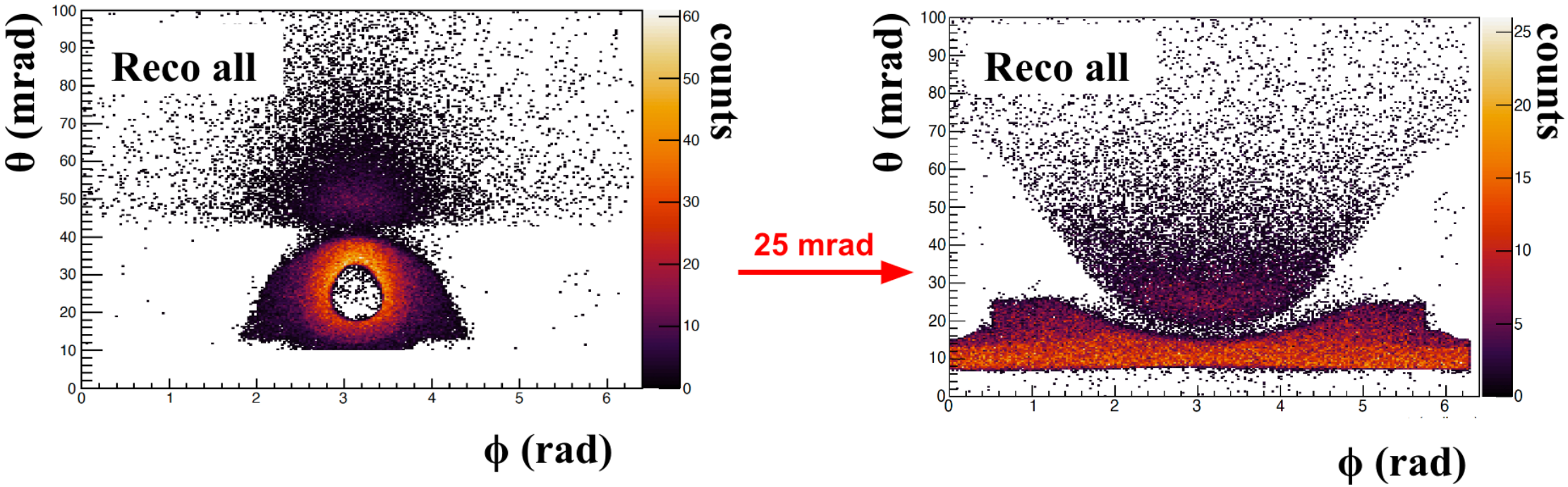


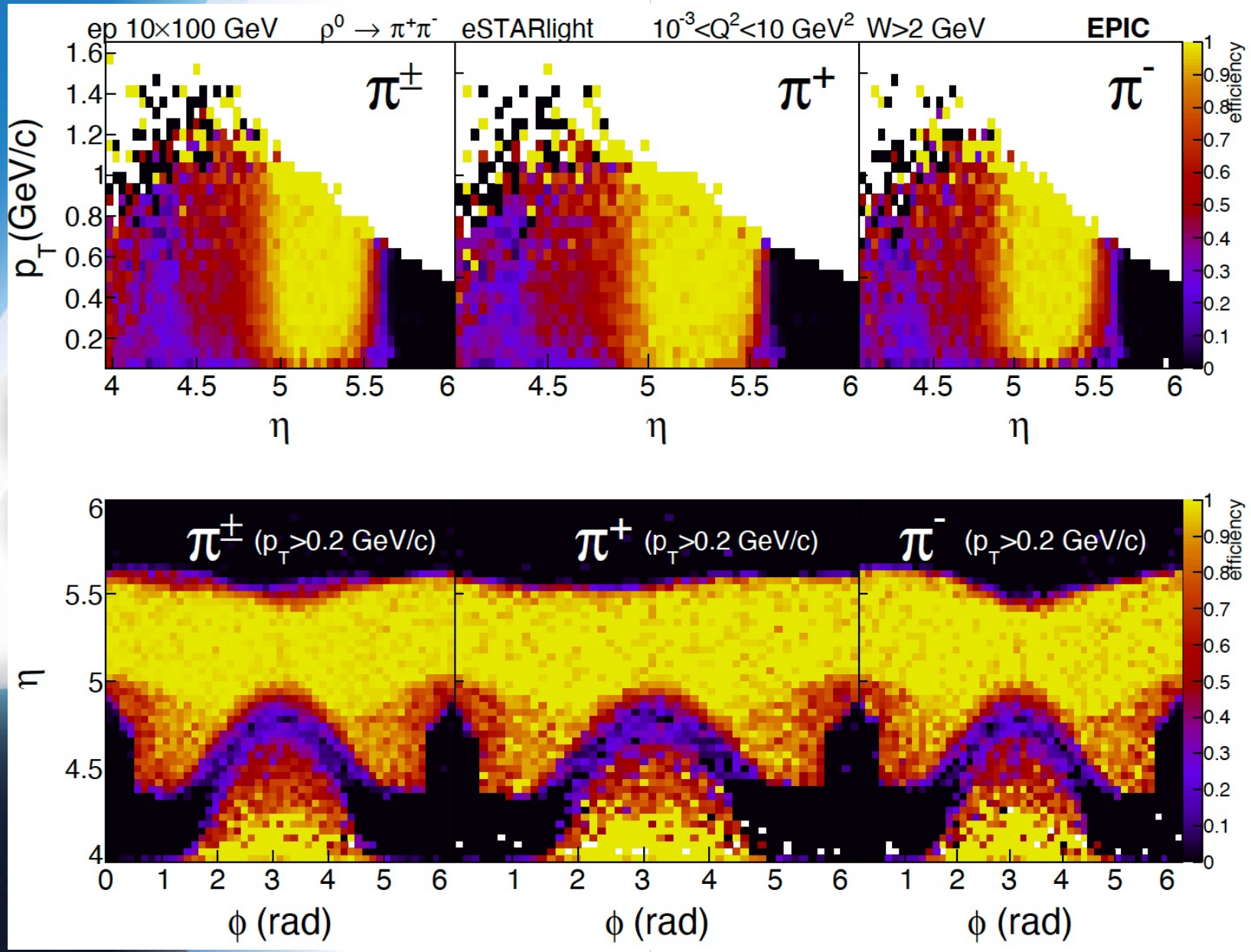
u-channel $\rho^0 \rightarrow \pi^+\pi^-$ in B0

- eicrecon uses coordinate system wrt electron beam pipe
- Far-forward tracks should be rotated by crossing angle

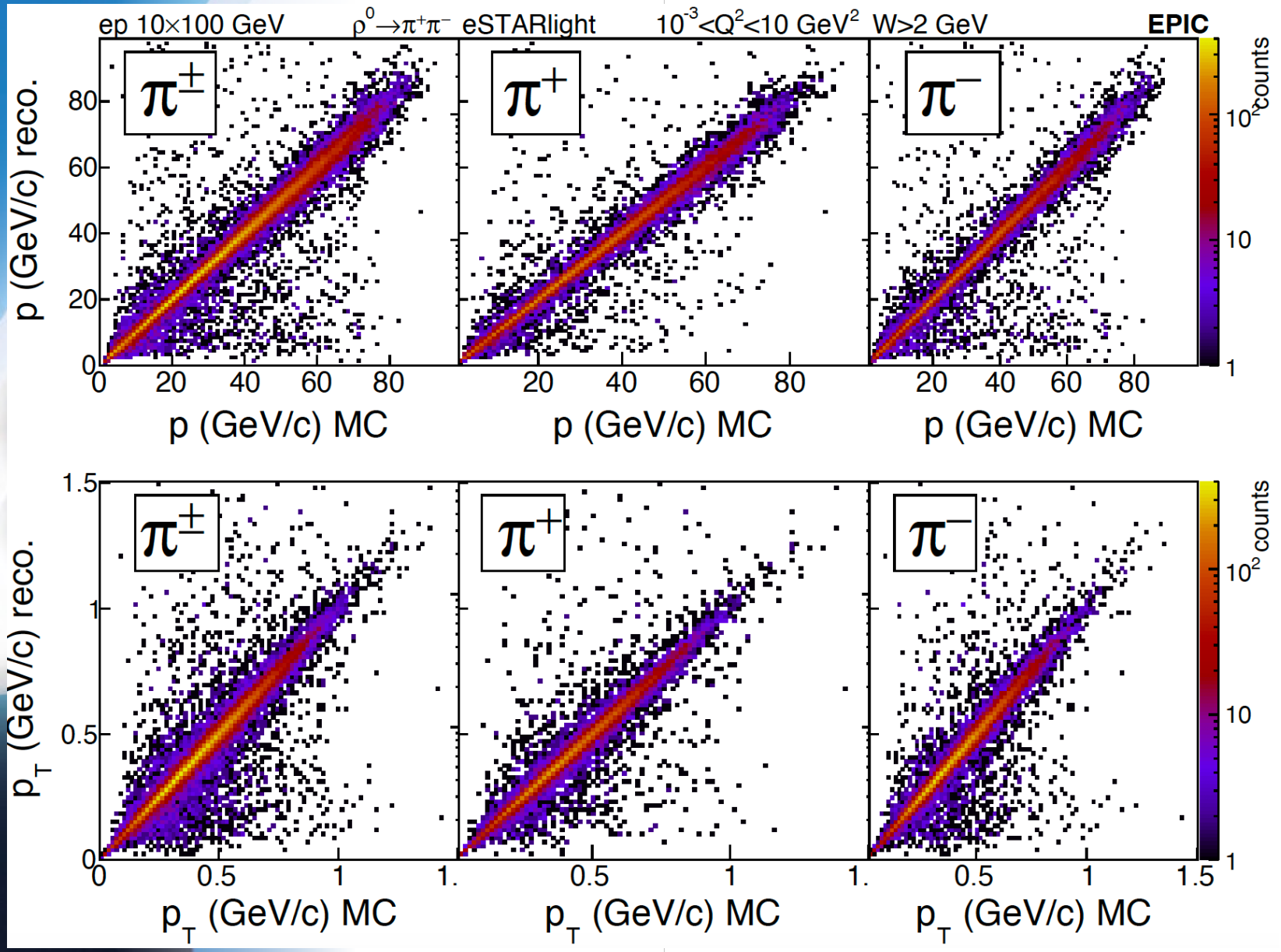
To analyze B0 reco tracks wrt the hadron beam:

```
track.RotateY(0.025);
```



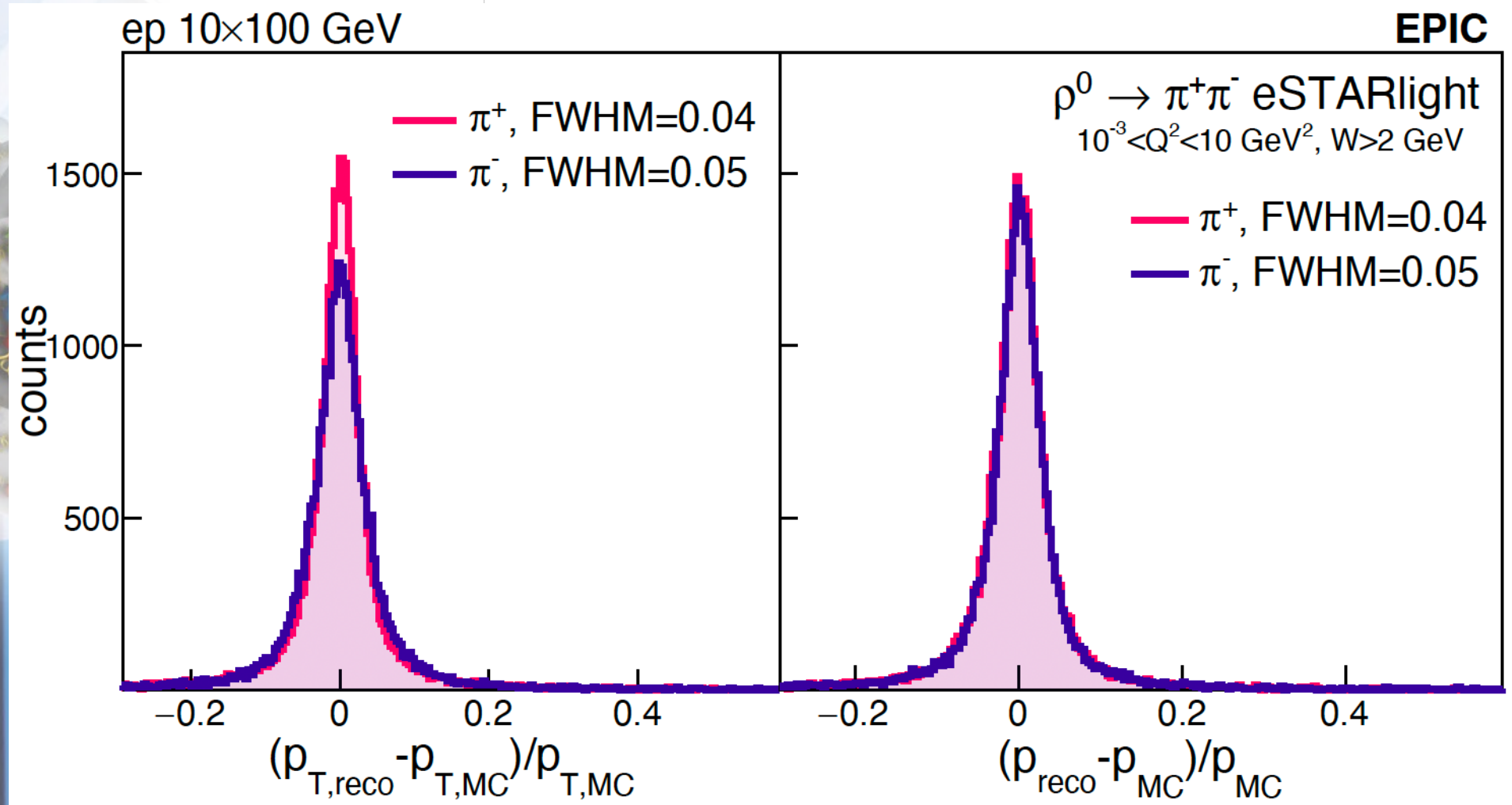


Benchamark plot: $\pi^+\pi^-$ reconstruction efficiency

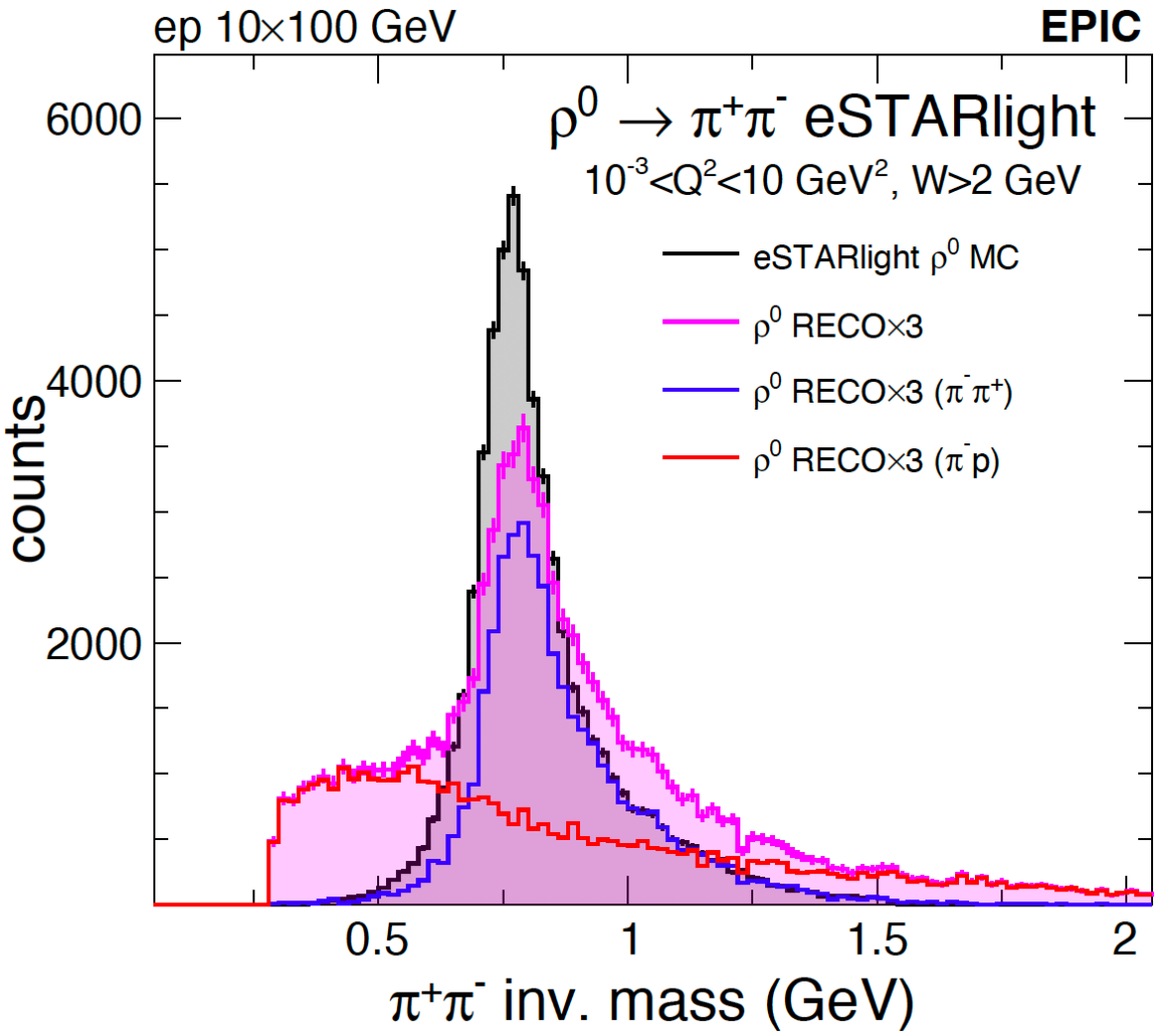


Benchamark plot: $\pi^+\pi^-$ reconstruction quality

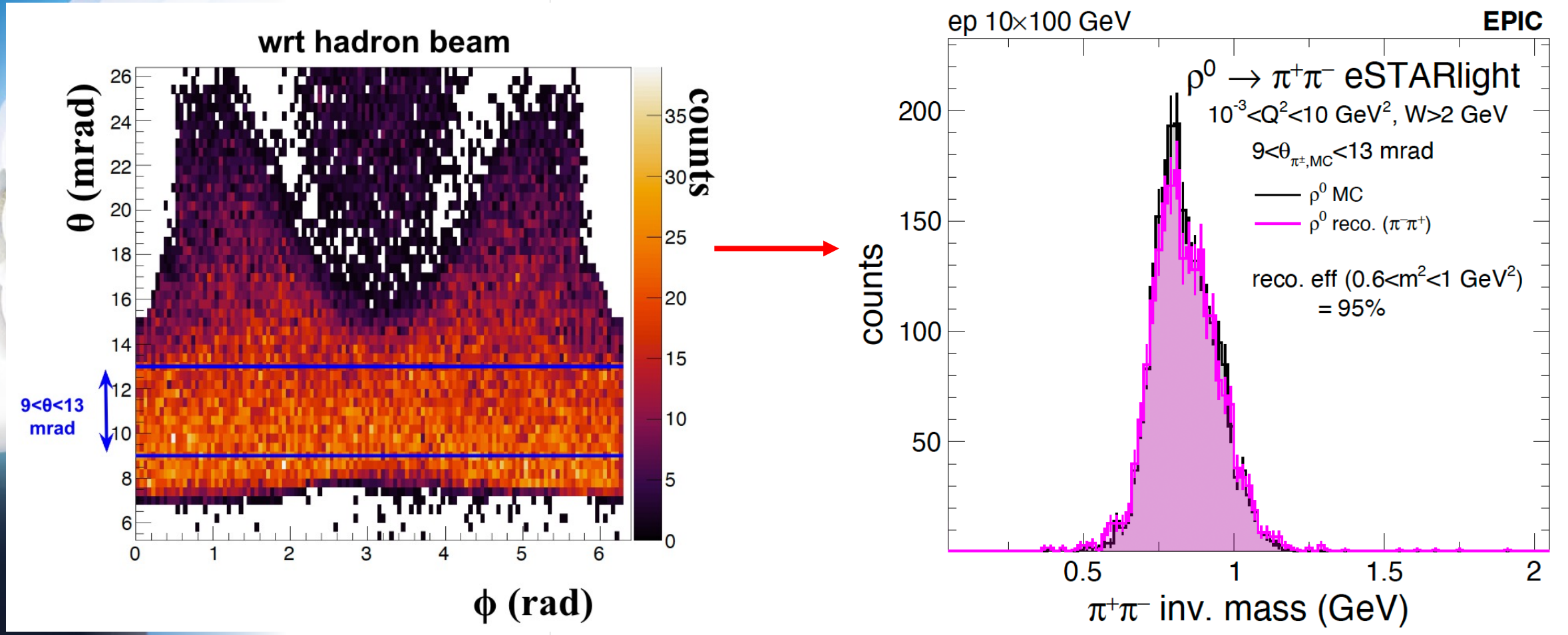
Benchamark plot: $\pi^+\pi^-$ reconstruction quality (percent)



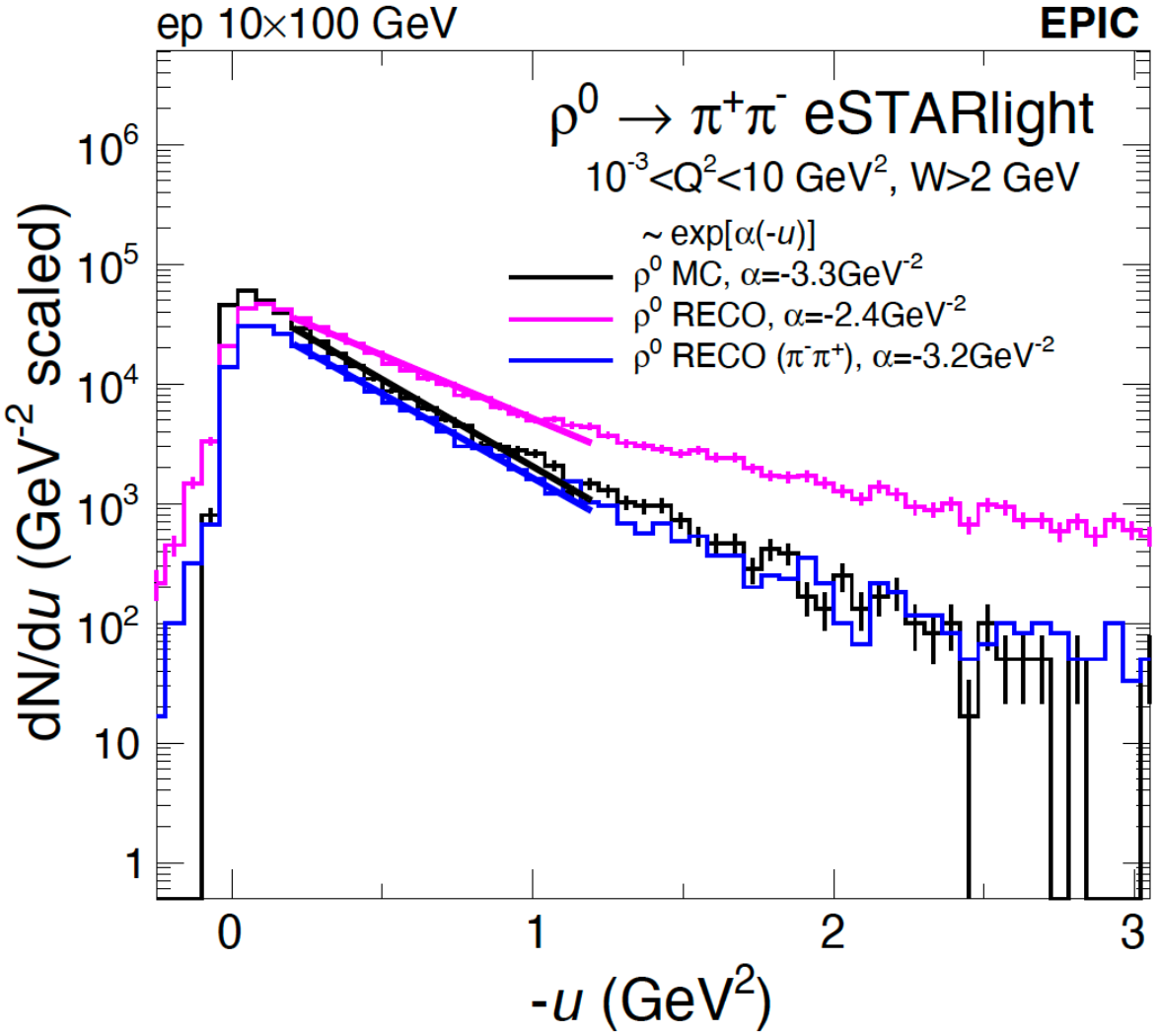
Benchamark plot: ρ^0 mass reconstruction



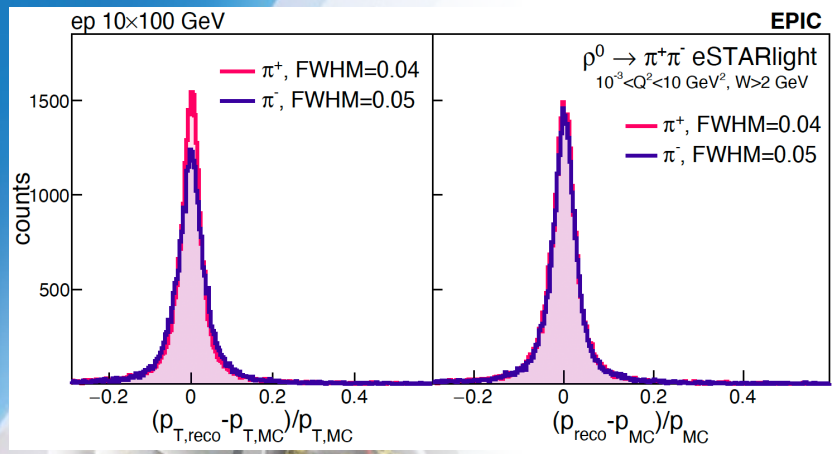
Benchamark plot:
ρ^0 mass reconstruction within B0

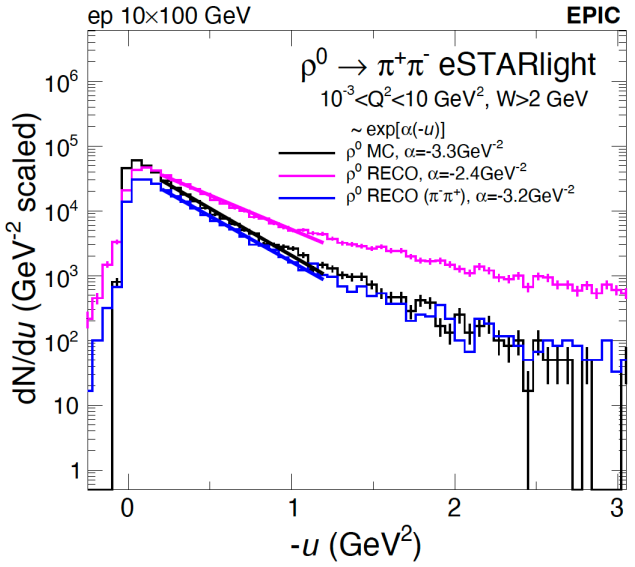


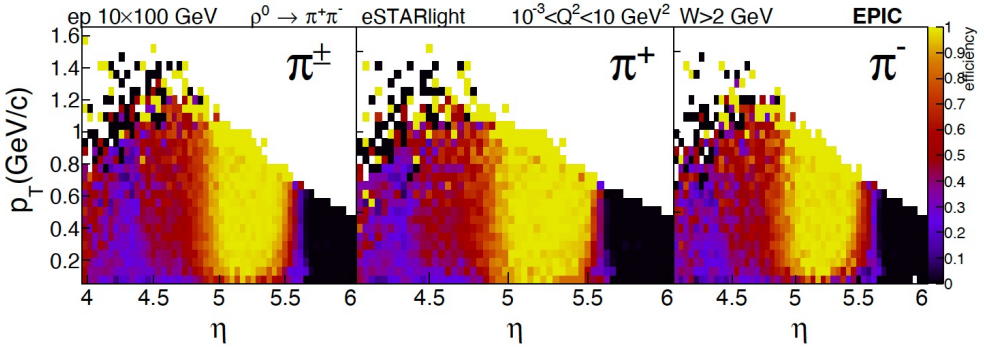
Benchamark plot: *u*-channel slope reconstruction

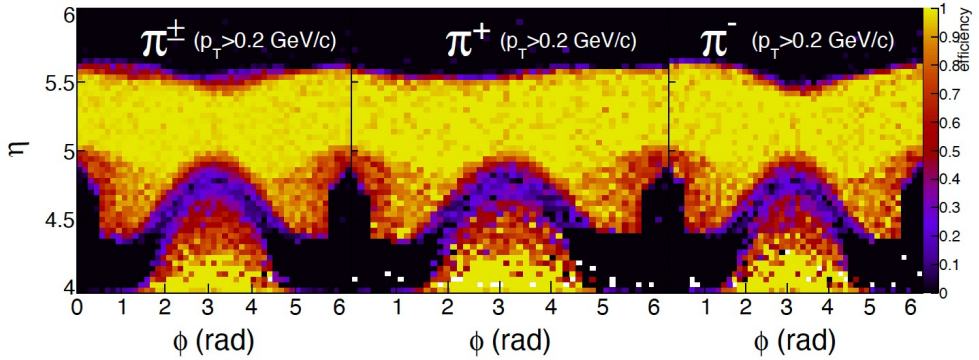


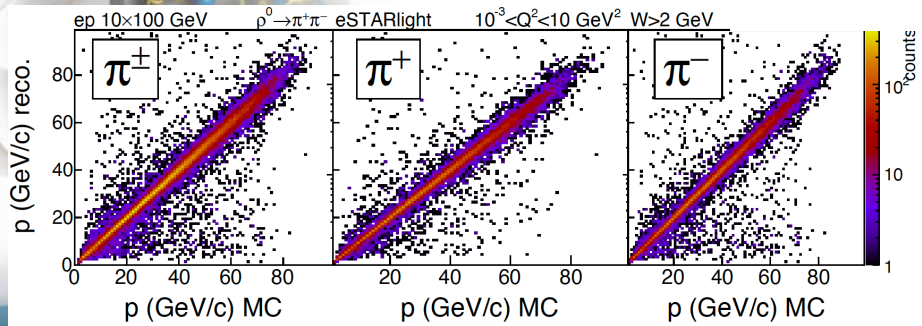
Benchmark Figures

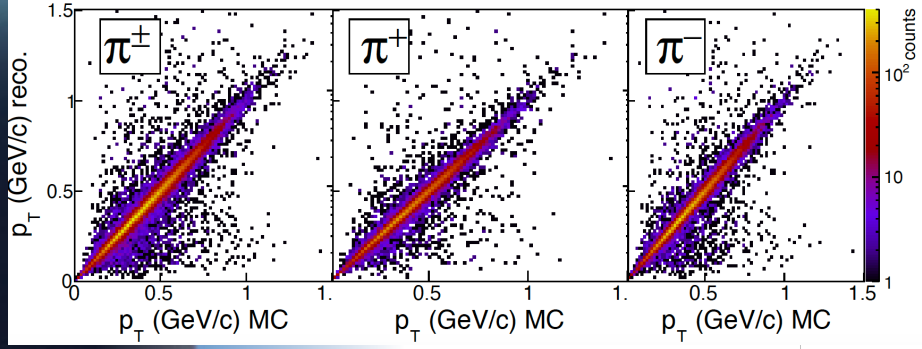


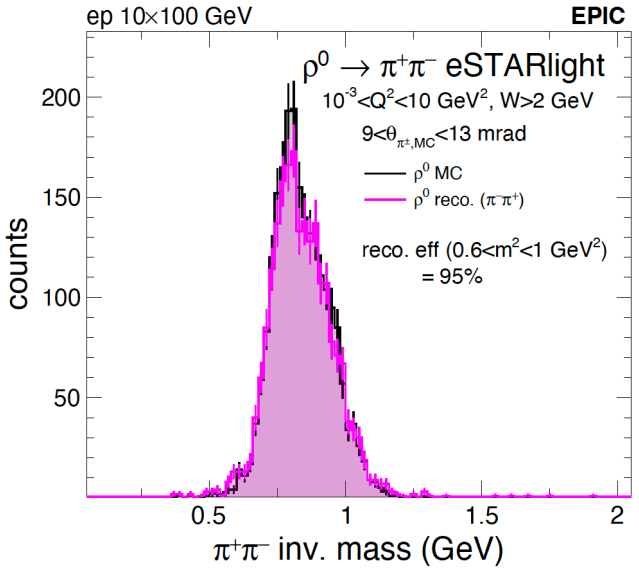


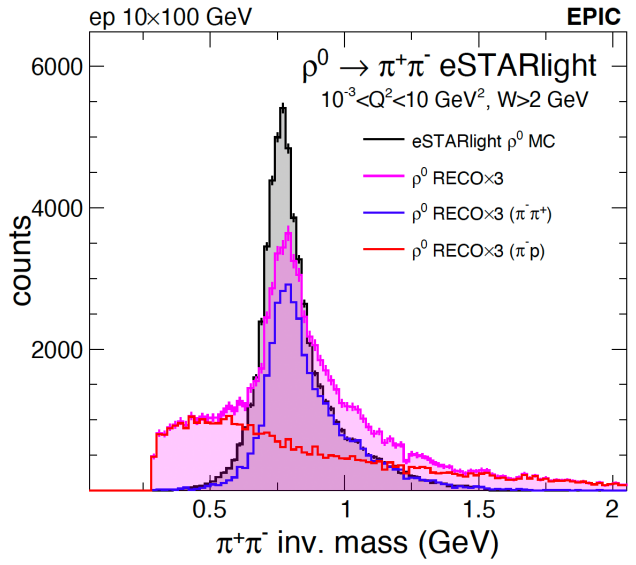




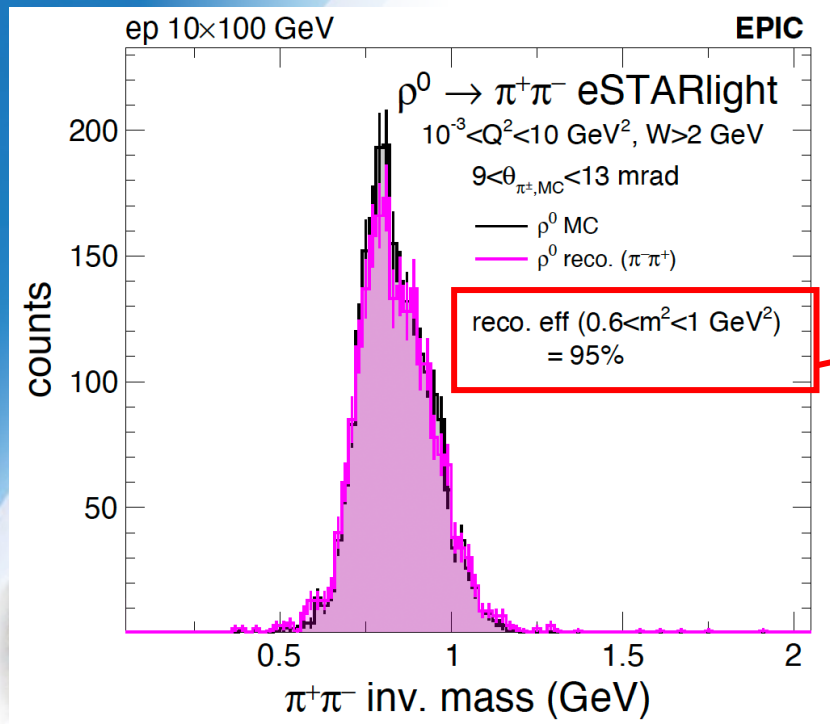






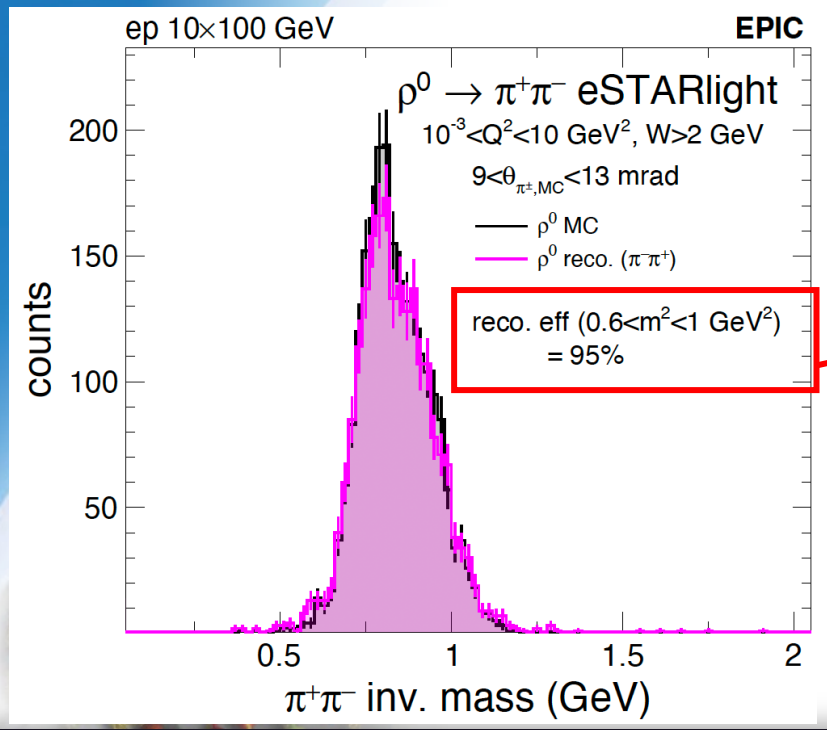


Benchmark Status Flag: ρ^0 Reconstruction Efficiency



- Raise a bad status flag if this eff. drops below 90%
- Status procedure detailed in `common_bench` repo

Benchmark Status Flag: ρ^0 Reconstruction Efficiency



- Raise a bad status flag if this eff. drops below 90%
- Status procedure detailed in `common_bench` repo
- The benchmark status flag seems to have worked

Explore Sign in Register

Search or go to...

EIC / benchmarks / physics_benchmarks / Jobs / #3123985

Project

physics_benchmarks

Manage

Plan

Code

Build

Pipelines

Jobs

Pipeline schedules

Artifacts

Deploy

Search job log

```
2178 Writing test data to rhorecoeff.json
2179 {
2180     "tests": [
2181         {
2182             "description": "u-channel rho->pi+pi- reconstruction efficiency when both pions should be within B0 acceptance",
2183             "name": "rho_reconstruction_efficiency",
2184             "quantity": "efficiency",
2185             "result": "pass",
2186             "target": "0.9",
2187             "title": "rho Reconstruction Efficiency for rho -> pi+pi- in the B0",
2188             "value": 0.9605459586265728,
2189             "weight": 1.0
2190         }
2191     ]
2192 }
```

Duration: 4 minutes 50 seconds
Finished: 14 minutes ago
Queued: 0 seconds
Timeout: 6h (from project)
Runner: #71 (Twswh3hWs) Runner on eic-n0 with write access to scratch
Tags: phy-scratch

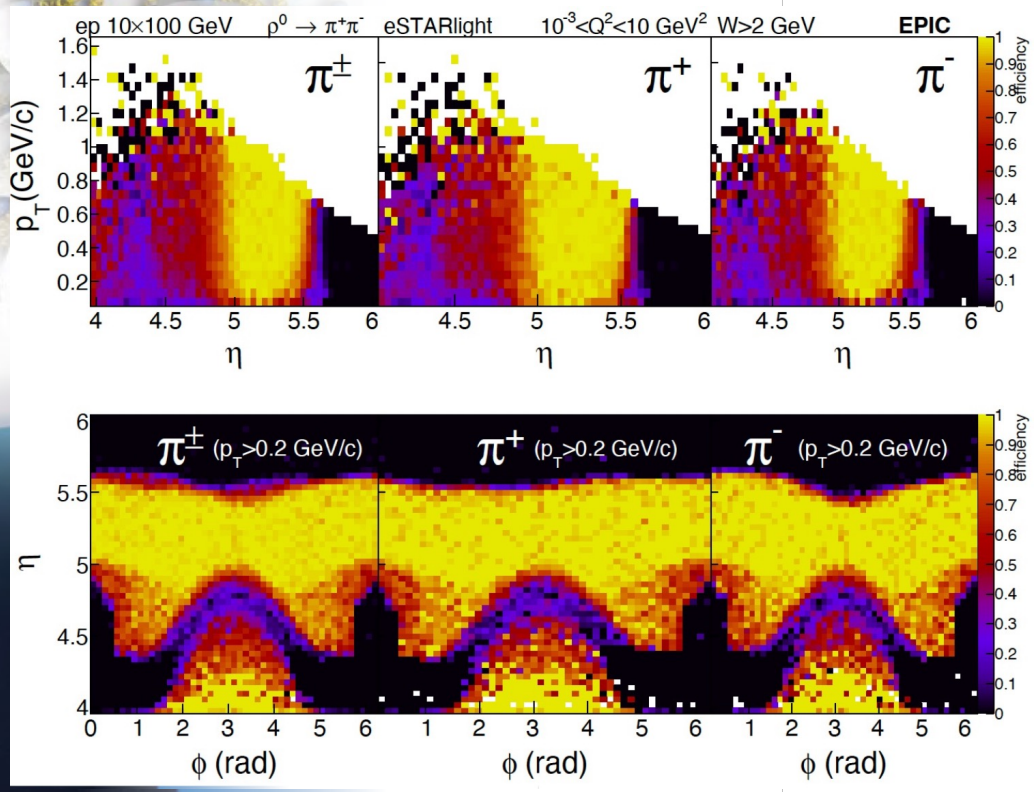
Job artifacts
These artifacts are the latest. They will not be deleted (even if expired) until newer artifacts are available.

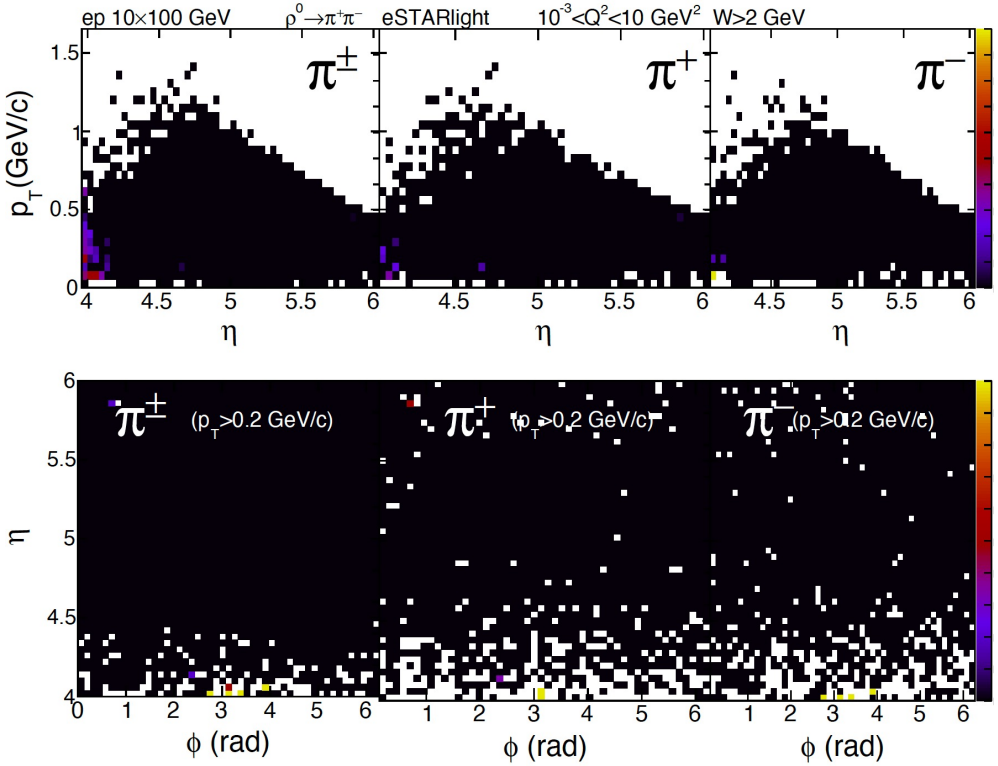
Download Browse

Trigger token: b5c6

Benchmark Efficiency

- Starting with the eictest/EPIC/RECO/24.05.0/epic_craterlake/ simulation campaign, far-forward efficiency drops to 0
- Efficiency defined as ratio between thrown generator-level pions to reconstructed pions (truth PID) binned with the generator-level kinematics



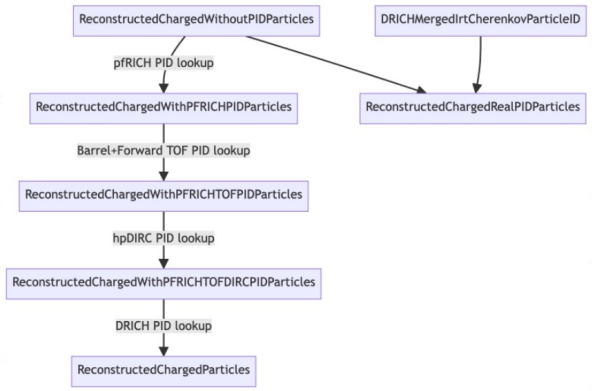


Change to ReconstructedChargedParticles.PDG

UC DAVIS
UNIVERSITY OF CALIFORNIA

- The reconstructed charged particles branch switched to realistic PID

How it works



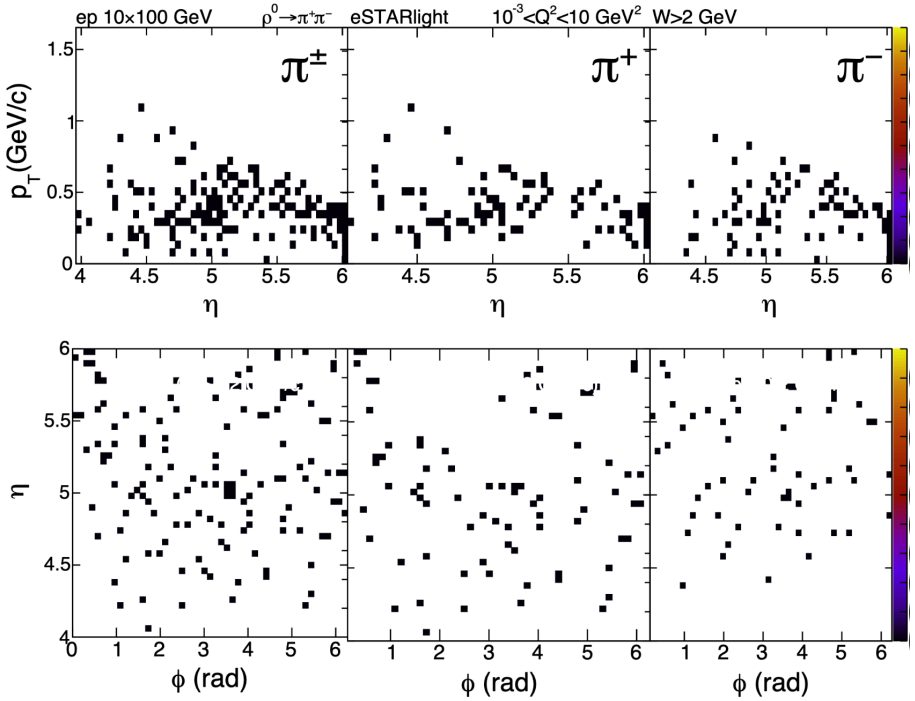
- Proper IRT PID diverted to another "RealPID" collection
- LUT PID is the new default
- Randomized value (see the original spec) stored to `edm4eic::ReconstructedParticle::PDG` field
- Each lookup step will overwrite the randomized value if LUT entry is found
- All found probabilities are stored in the `edm4eic::ReconstructedParticle::particleIDUsed` relation
- `edm4hep::ParticleID::type` stores which detector's LUT table the values came from

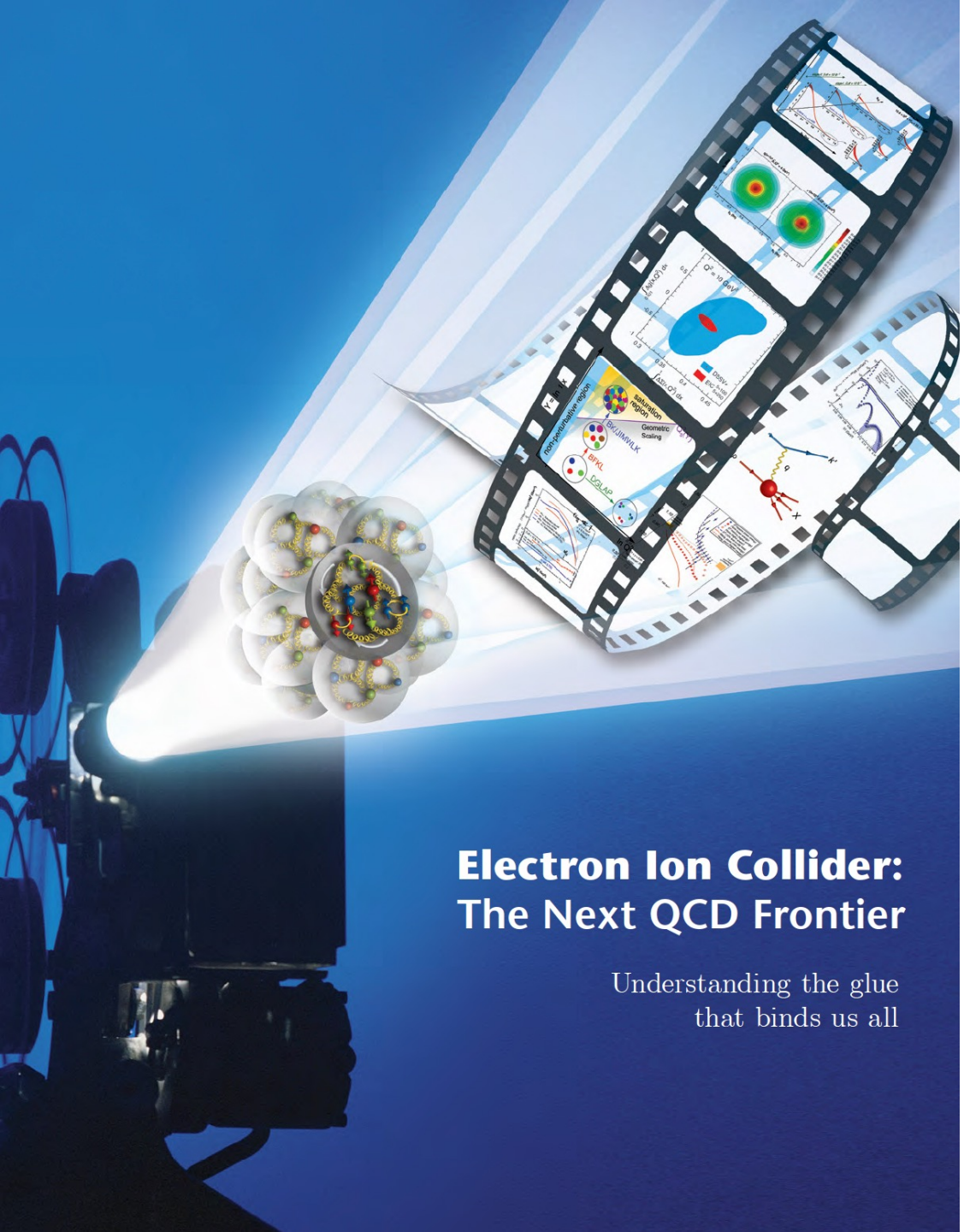
University of Kentucky

3

ReconstructedChargedParticleAssociations

- Now ReconstructedChargedParticleAssociations can be used to match a reconstructed particle to an MC particle
- This was implemented in https://github.com/eic/physics_benchmarks/blob/pr/u_channel_sweger/benchmarks/u_rho/analysis/uchannelrho.cxx
- No success yet (but small test sample), but 0 matched tracks

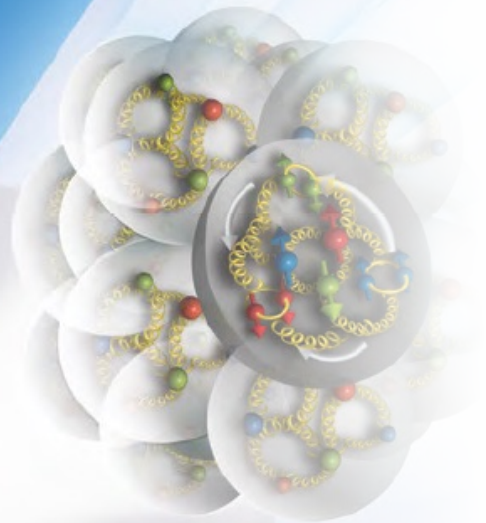




Conclusions

UC DAVIS
UNIVERSITY OF CALIFORNIA

- u-channel ρ production is an excellent benchmark for far-forward tracking performance
- Changes to data structure for eicrecon output starting in May have altered benchmark performance
- Things to check
  - double-check implementation of particle associations
  - check whether any far-forward tracks are being reconstructed
  - try higher-statistics sample



Thank you for your attention!

zwsweger@ucdavis.edu