

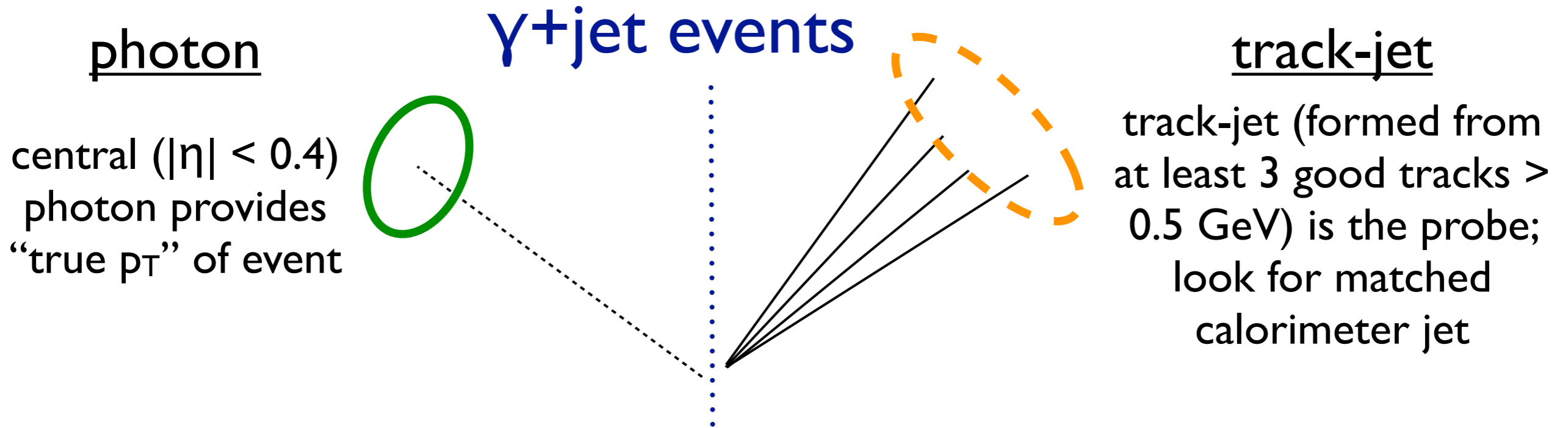
Data-Driven Measurement of Jet Efficiency using Track-Jets

S. Majewski, F. Paige, M. Begel (BNL),
A. Schwartzman (SLAC)

ATLAS Hadronic Calibration Workshop

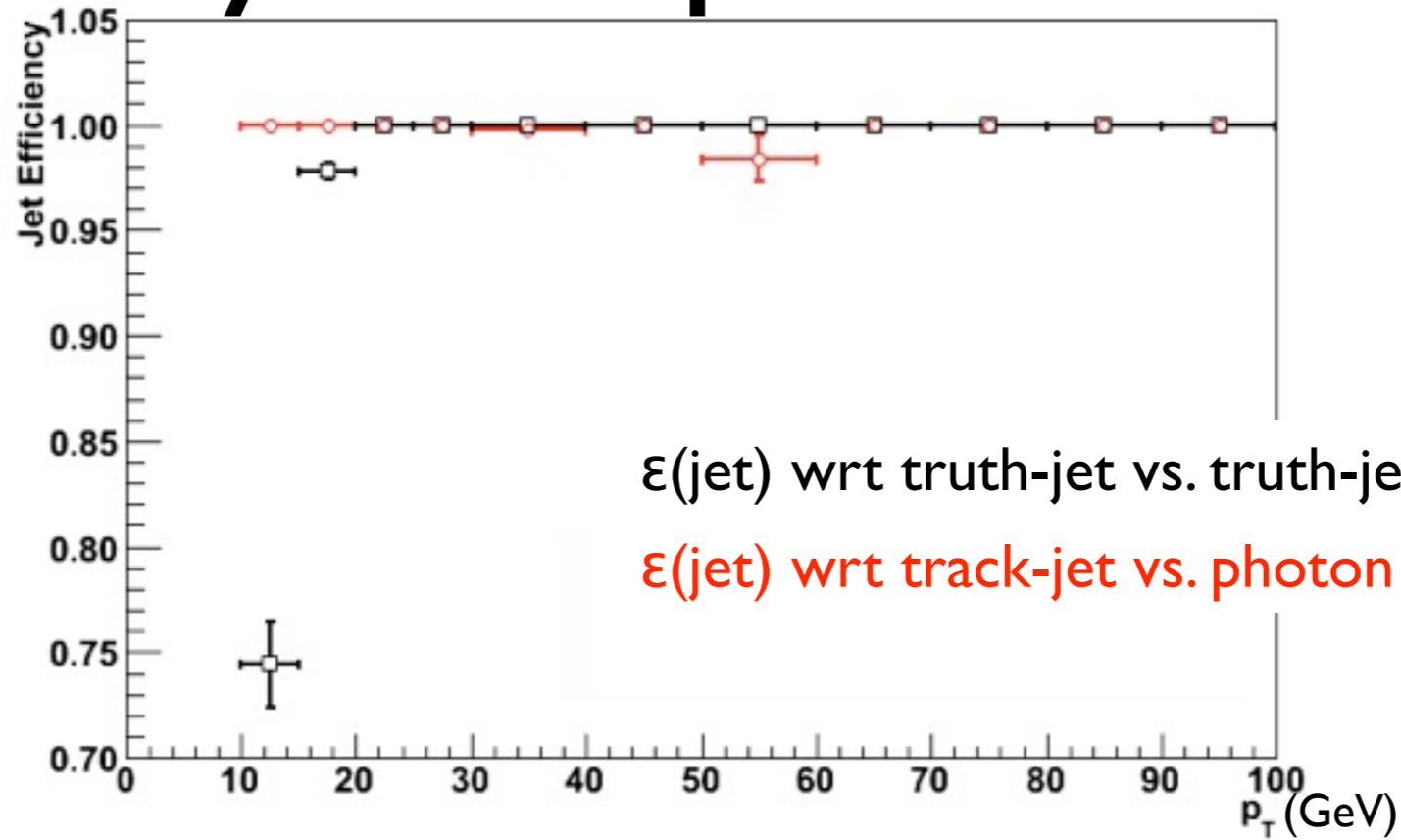
Portugal, 23–27 June 2009

Data-Driven Method



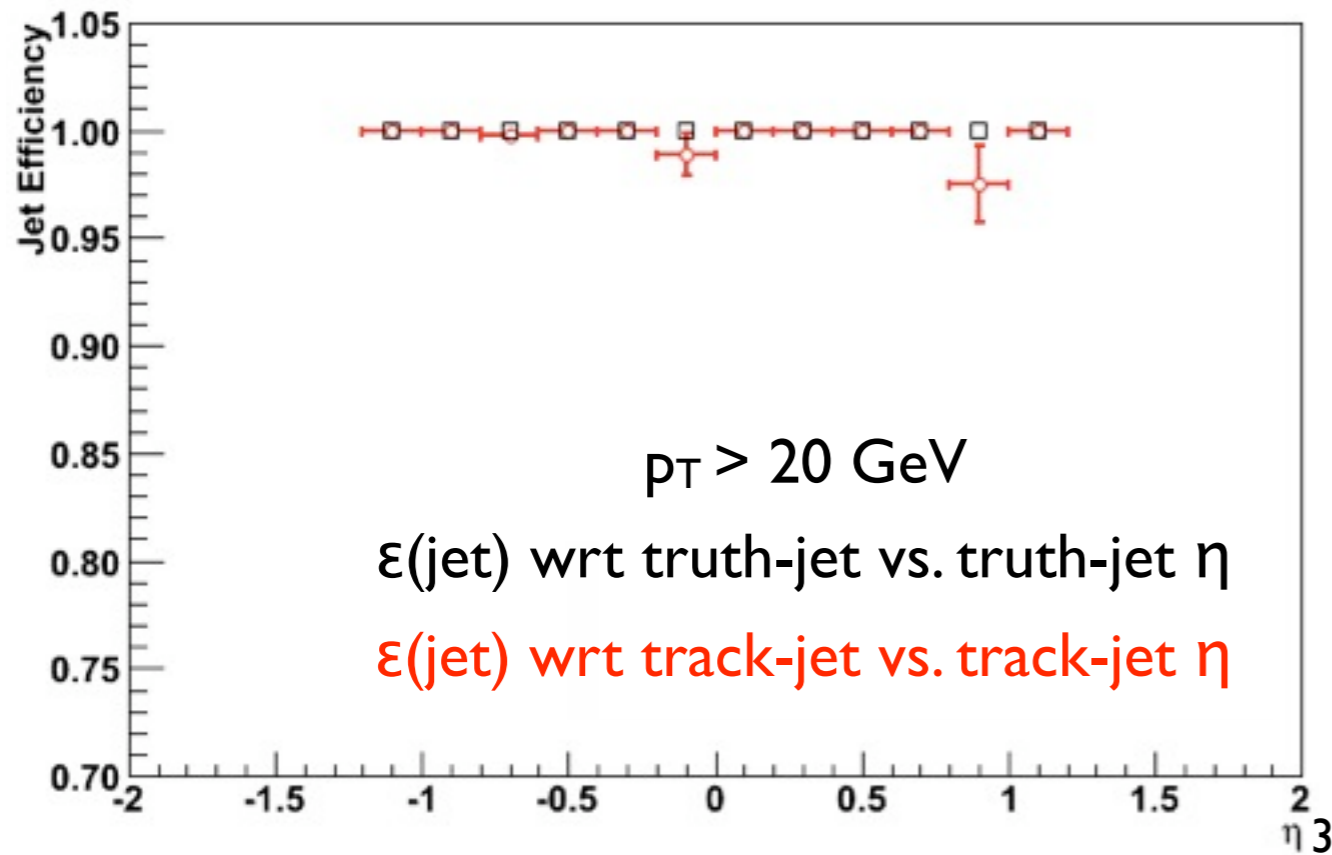
- Divide the event into 2 hemispheres in ϕ :
 1. Isolated photon
 2. One track-jet, $d = 0.4$
- Given the track-jet, require a tight ΔR match (0.15) between the track-jet and the calorimeter jet ($d = 0.6$)

Efficiency Compared to Truth



$\epsilon(\text{jet})$ wrt truth-jet vs. truth-jet p_T

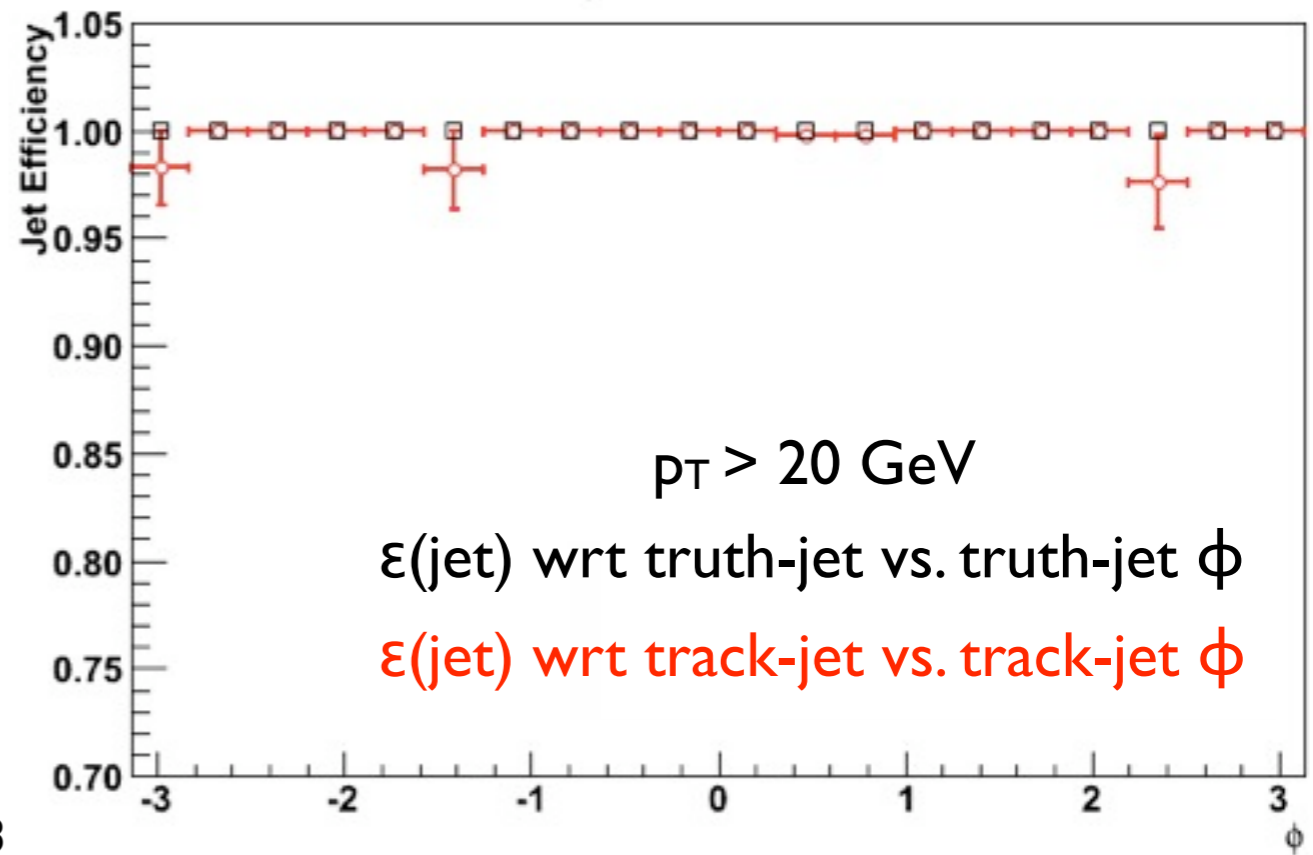
$\epsilon(\text{jet})$ wrt track-jet vs. photon p_T



$p_T > 20$ GeV

$\epsilon(\text{jet})$ wrt truth-jet vs. truth-jet η

$\epsilon(\text{jet})$ wrt track-jet vs. track-jet η



$p_T > 20$ GeV

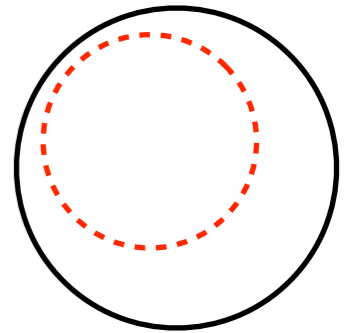
$\epsilon(\text{jet})$ wrt truth-jet vs. truth-jet ϕ

$\epsilon(\text{jet})$ wrt track-jet vs. track-jet ϕ

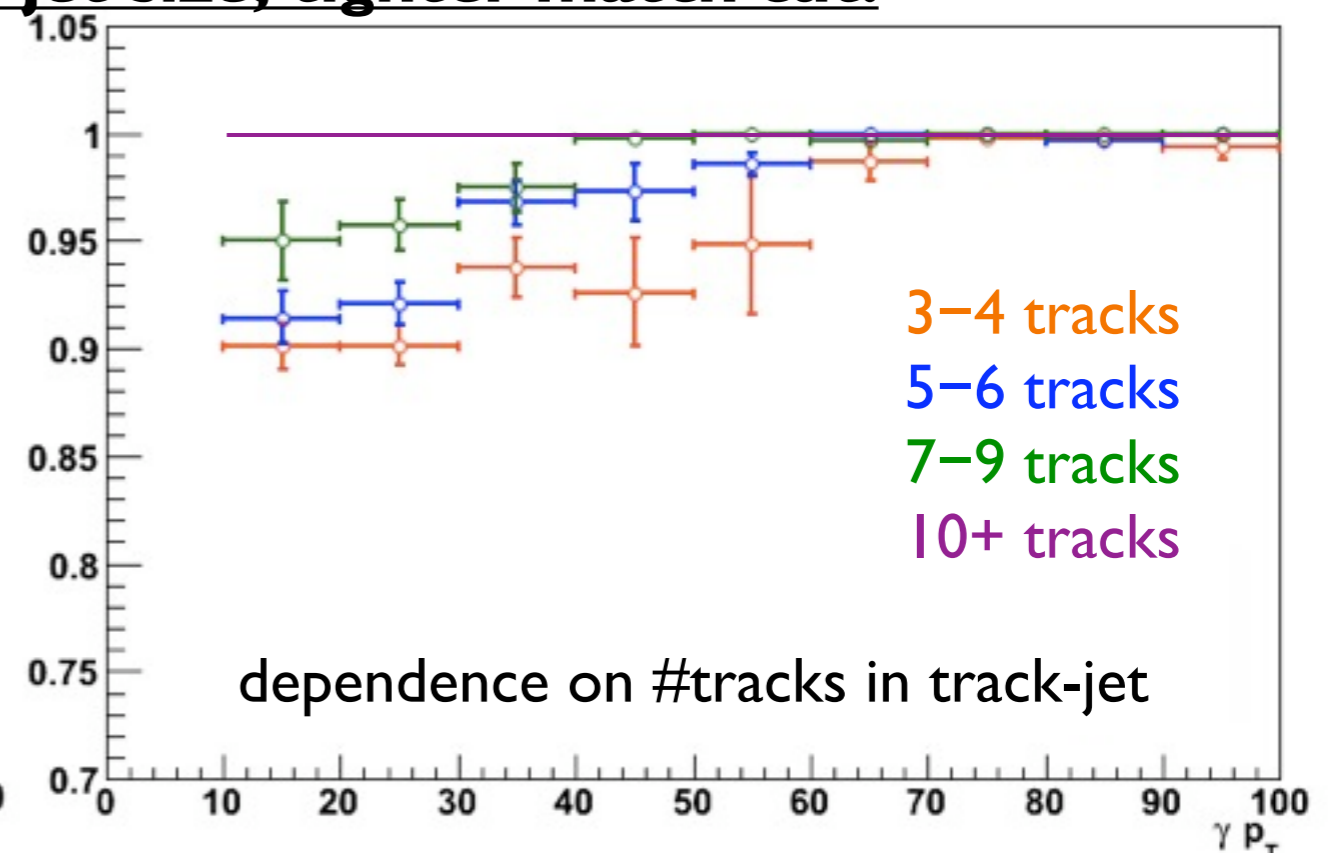
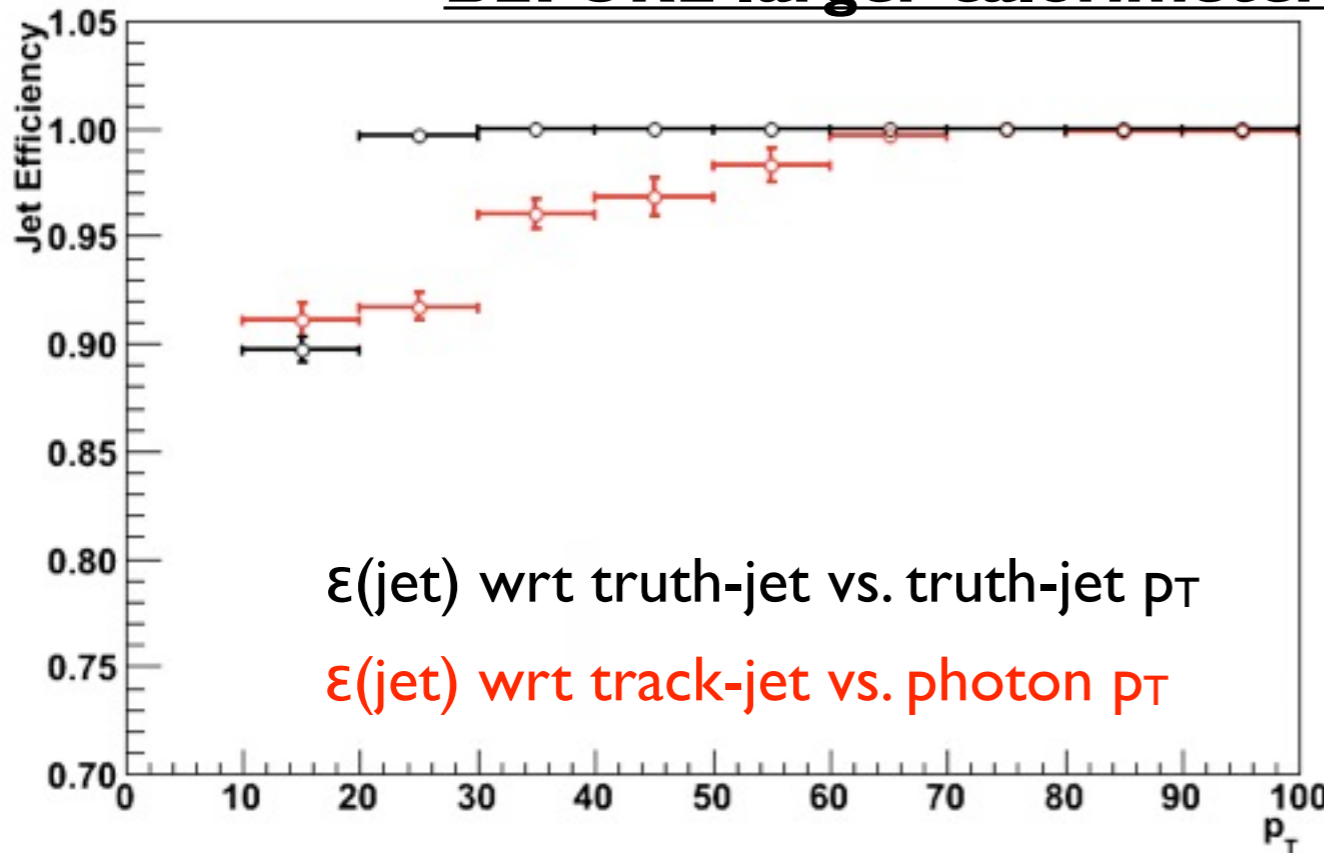
Sources of Bias

I. Cone size of track-jet compared to calorimeter jet

- low- p_T tracks bend out of jet; require hadronic part of shower to be contained in jet
- $d = 0.4$ track-jet for $d = 0.6$ calorimeter jet; match $\Delta R < 0.15$

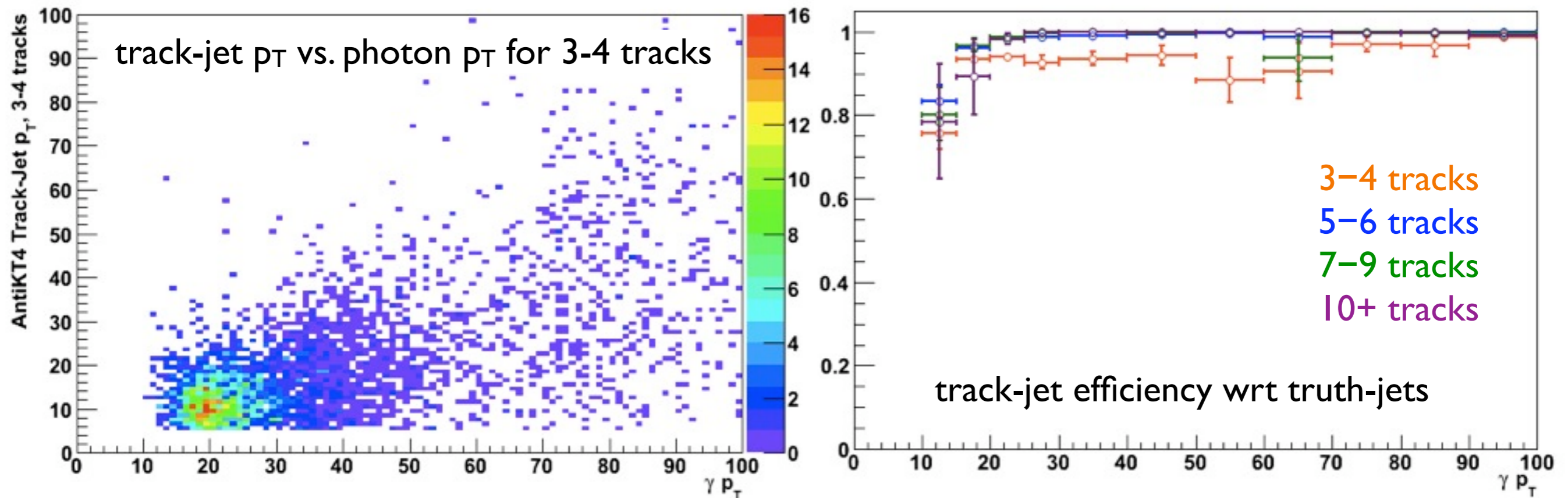


BEFORE larger calorimeter jet size, tighter match cut:



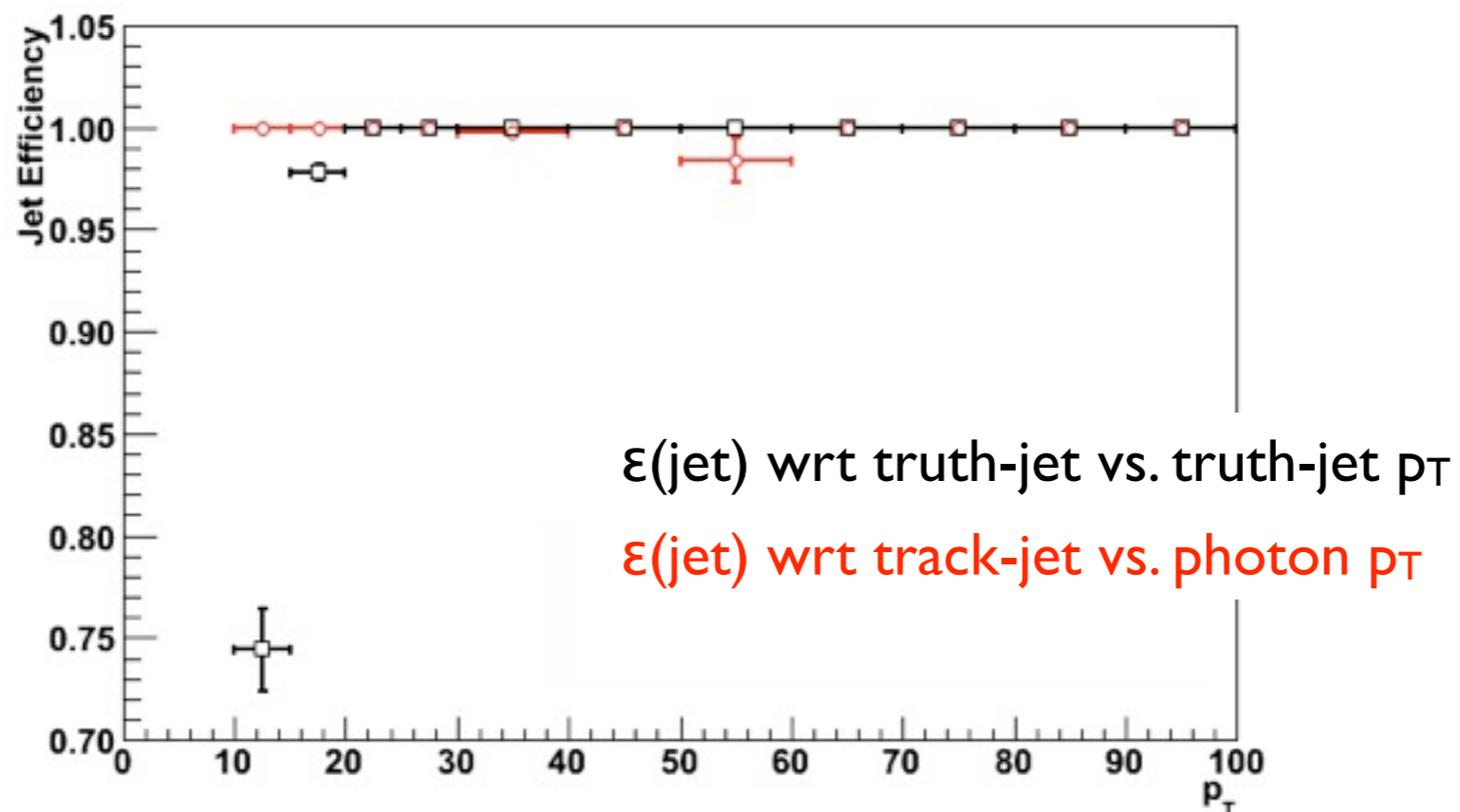
Sources of Bias

2. Strong inverse dependence on #tracks in track-jet (ϵ for 10+ tracks in track-jet = 1)
 - track-jet inefficiency \rightarrow multiplicity-dependent minimum p_T cut
 - veto of other track-jets in the hemisphere



Summary

- With some heroics, the biases can be minimized/eliminated...
- But the efficiency dependence with respect to the #tracks in the track-jet is not fully understood



Additional Information

Datasets:

```
group08.PerfJets.mc08.108001.PythiaPhotonJet1.recon.DPD_NOSKIM.e344_s456_r545_DPDMaker000157_p1
group08.PerfJets.mc08.108002.PythiaPhotonJet2.recon.DPD_NOSKIM.e344_s456_r545_DPDMaker000157_p1
group08.PerfJets.mc08.108003.PythiaPhotonJet3.recon.DPD_NOSKIM.e344_s456_r545_DPDMaker000157_p1
```

(350k events; combined and weighted by cross-section)

Anti- k_T Jet Building:

Track-Jets:

- Select tracks with ≥ 7 silicon hits and $p_T > 0.5$ GeV; input into JetTrackZClusterTool
(UseVertexSeeding=False, require $z < 10$ mm)
- Output is a jet container with track constituents
(min track-jet $p_T = 5$ GeV, min #tracks = 3, $d = 0.4$)

Calorimeter Jets:

- Built from topoclusters; HI-calibrated, $d = 0.6$