Reconstruction and electron ID

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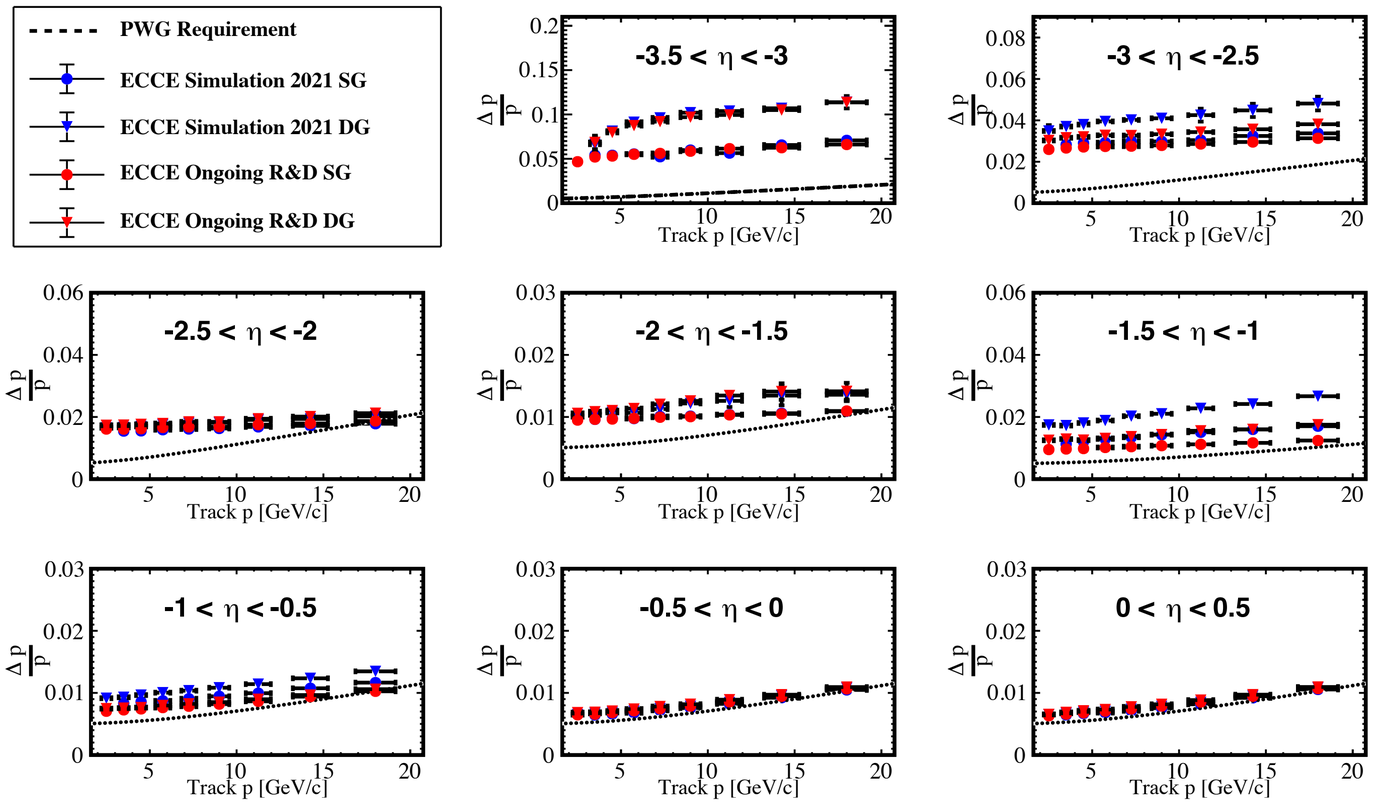
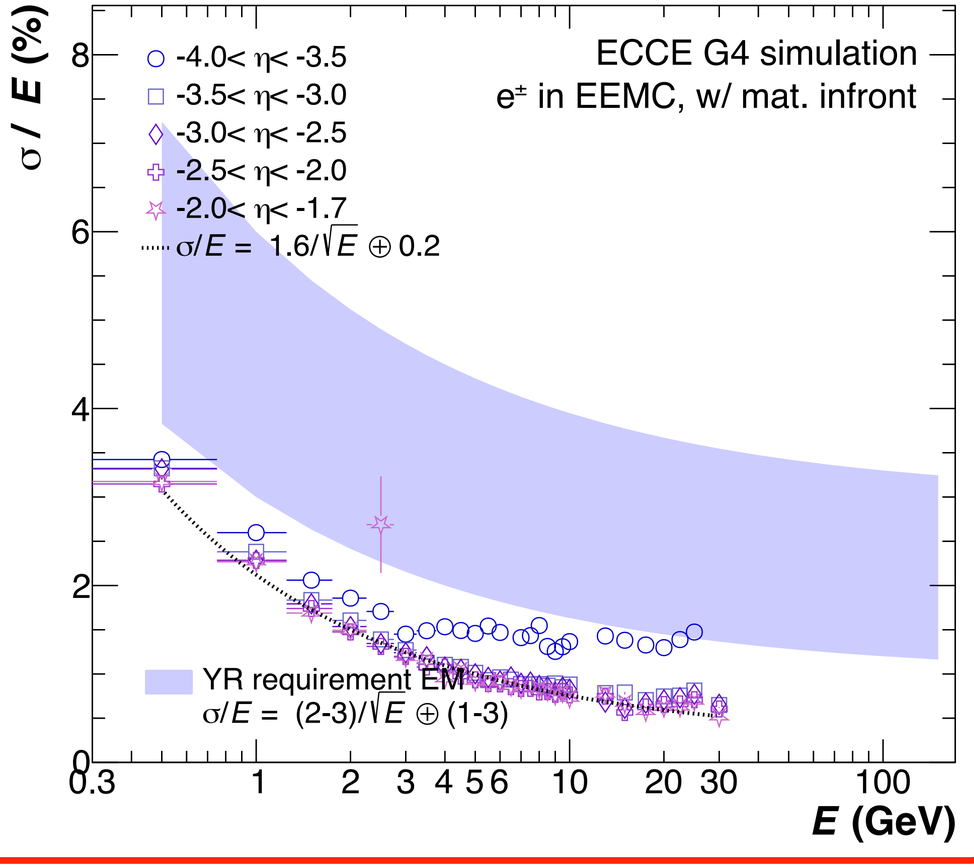
Calorimeter achieves better energy resolution than tracking in backward endcap

Tracking



Calorimeter

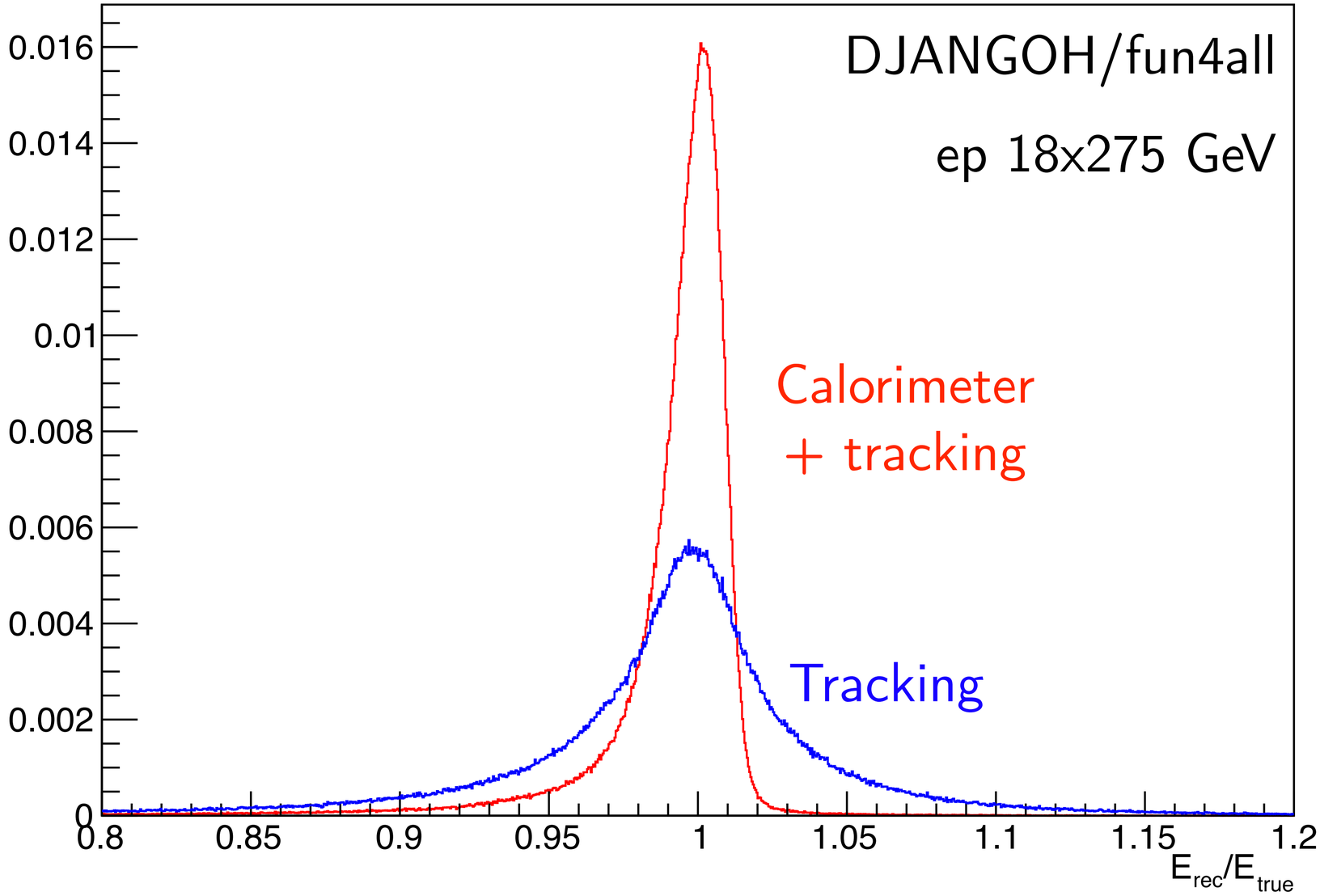


Exploit calorimeter resolution in electron reconstruction

- Weighted average of tracking and calorimeter energies to determine electron energy
- Obtain energy resolution of tracking (σ_{tr}) and calorimeter (σ_{cal}) from (η, p) map
- Calculate electron energy as:

$$E' = \frac{E_{tr}/\sigma_{tr}^2 + E_{cal}/\sigma_{cal}^2}{1/\sigma_{tr}^2 + 1/\sigma_{cal}^2}$$

Calorimeter achieves better energy resolution than tracking in backward endcap



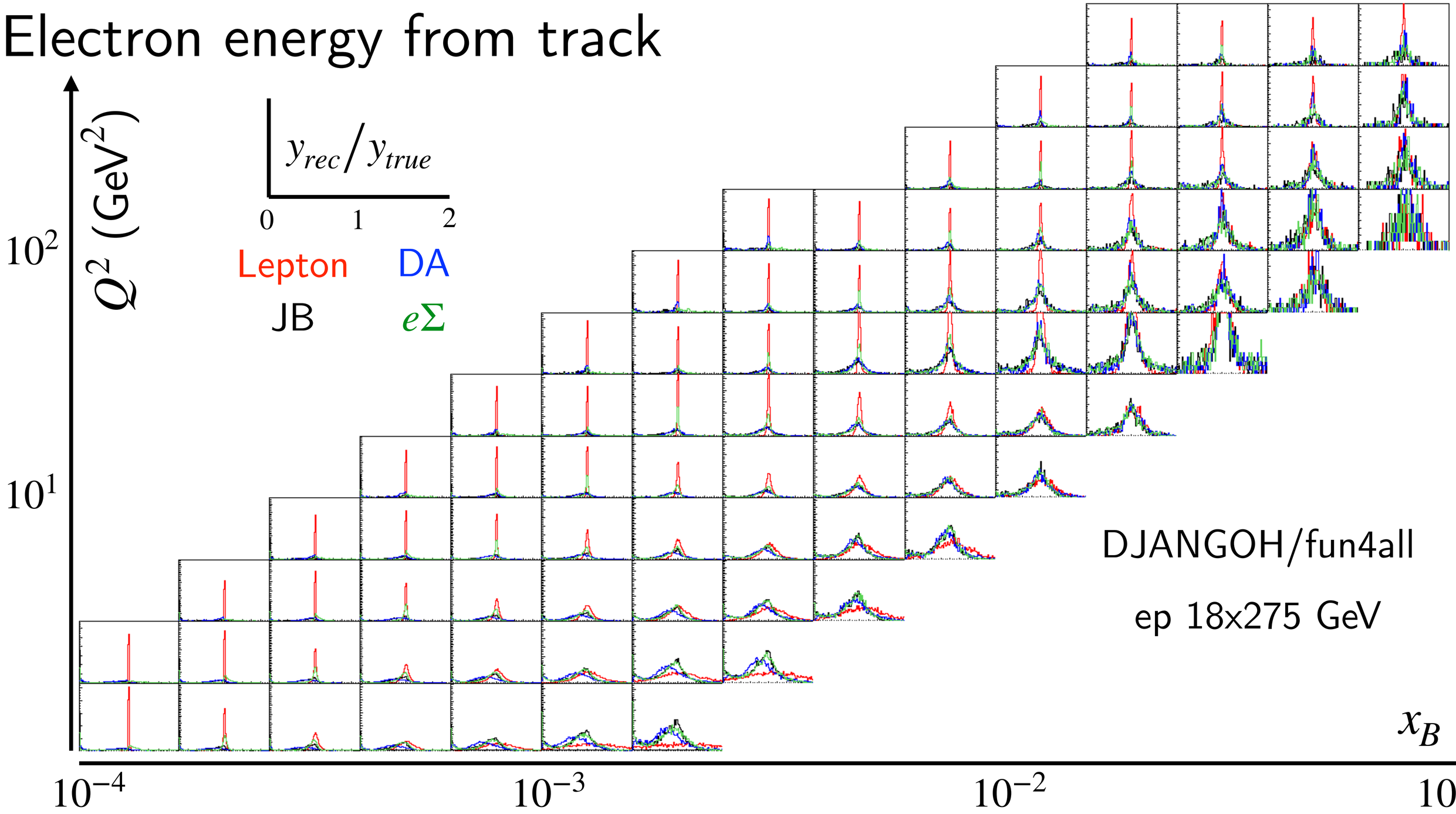
Kinematic reconstruction

- Study four reconstruction methods:
  - Lepton*
  - Jacquet-Blondel
  - Double-angle*
  - $e\Sigma$*

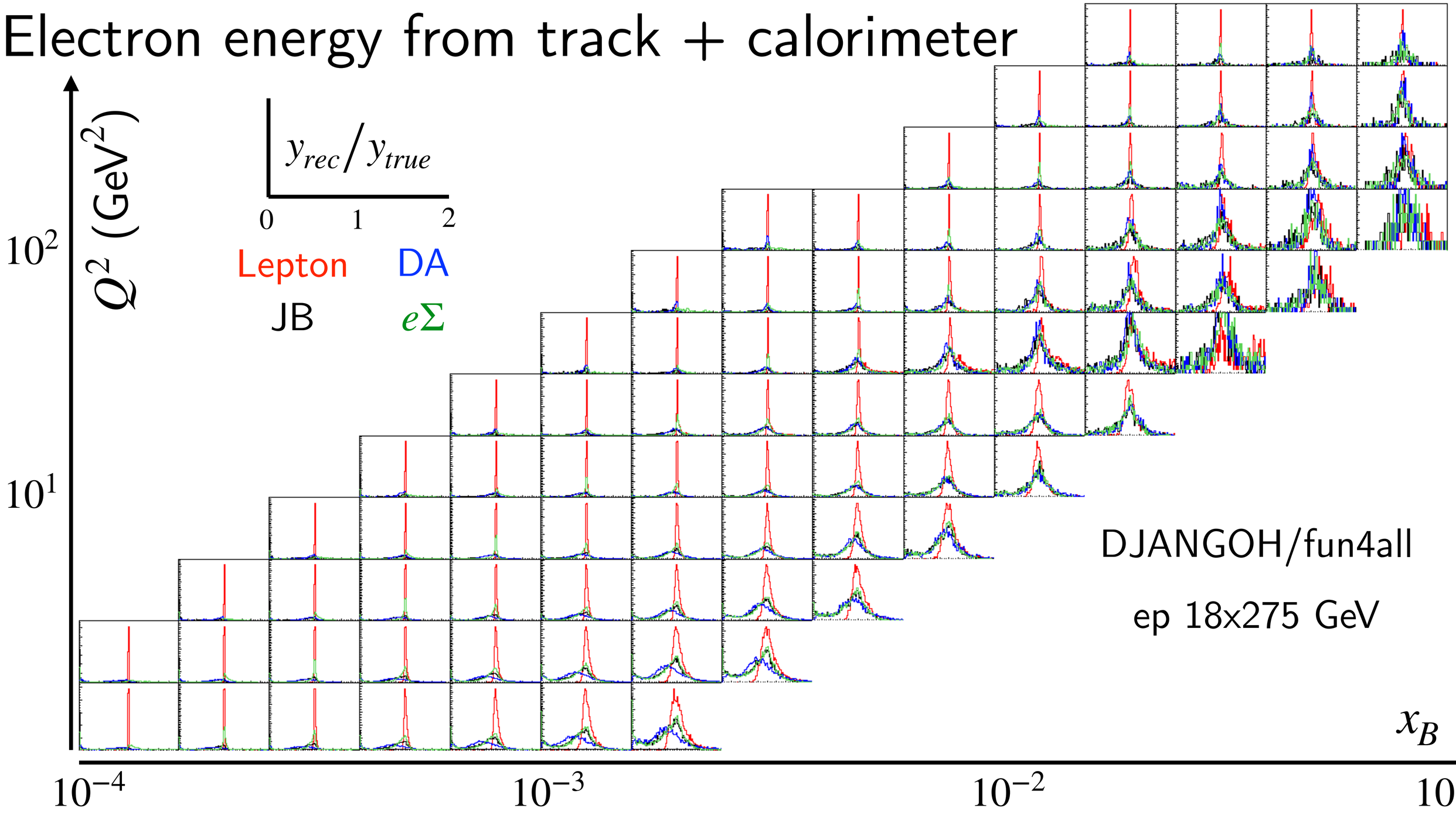
  *sensitive to electron energy

- Repeat reconstruction twice to show impact of including calorimeter energy

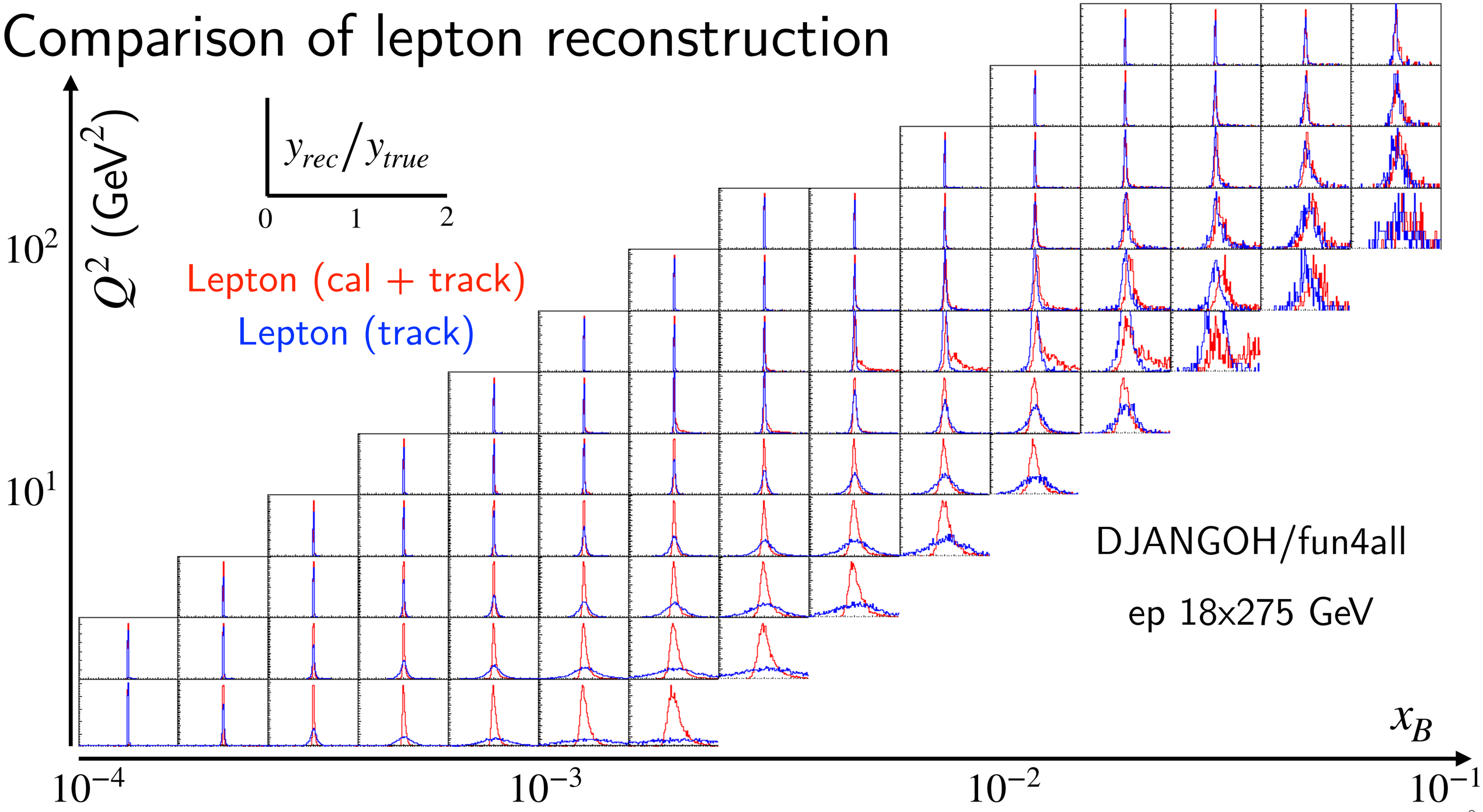
Electron energy from track



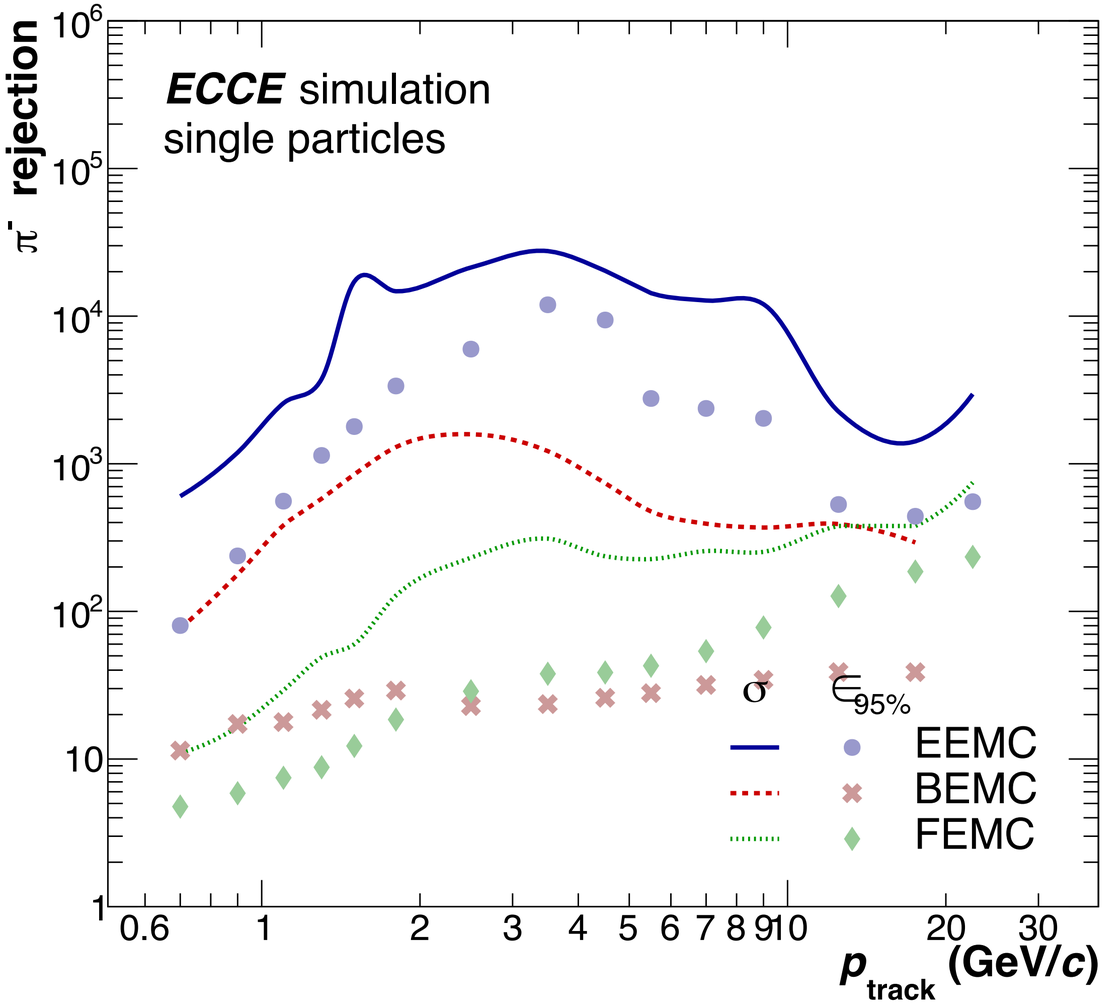
Electron energy from track + calorimeter



Comparison of lepton reconstruction



eID from E/p

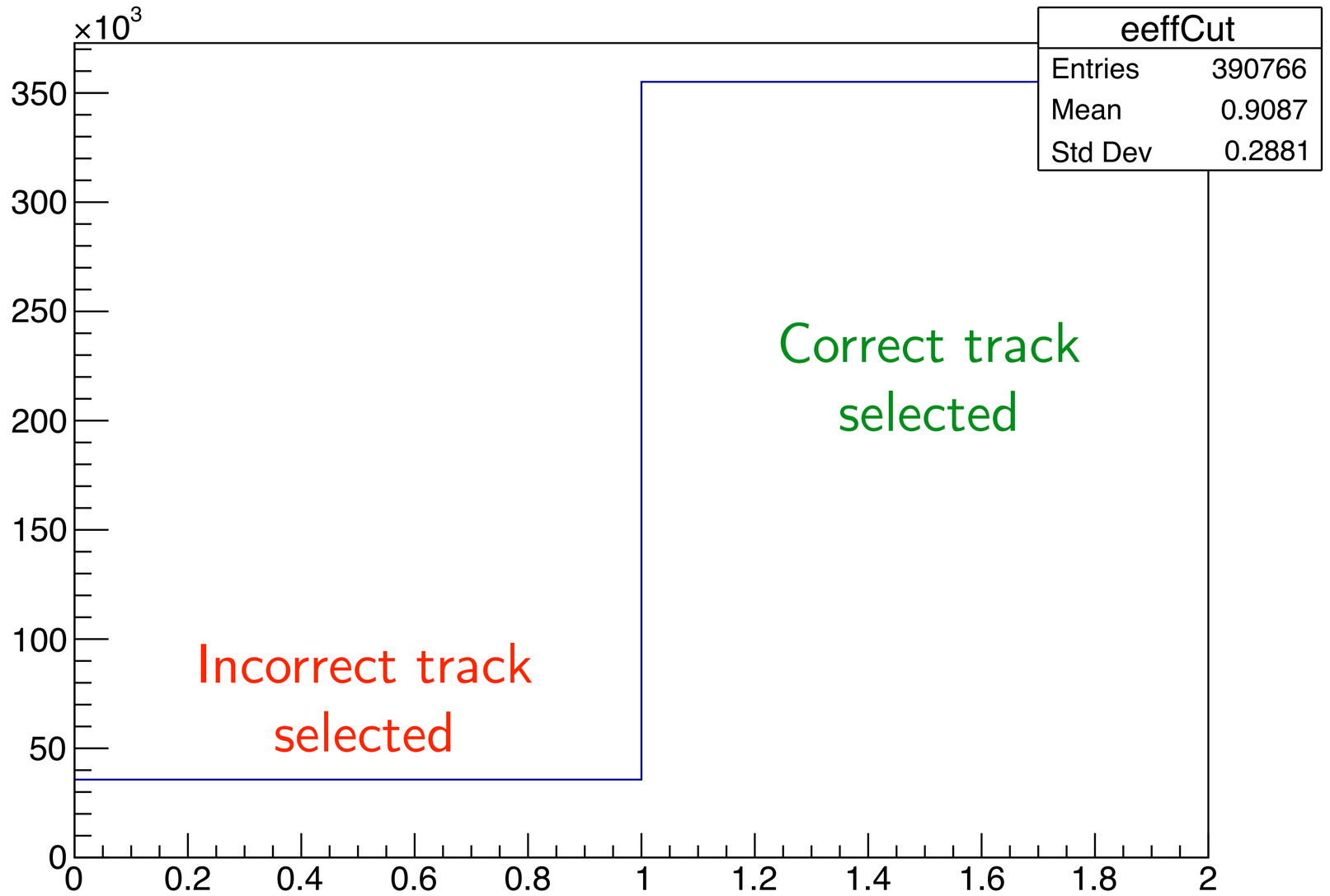


- Pion rejection from E/p degrades rapidly for $p < 2$ GeV
- Electron ID here must be supplemented by other detectors (RICH, DIRC, TOF) which provide significant rejection at low momentum

Simple test of eID: max E/p is electron track

$\eta >$ -3.2

$p >$ 2 GeV



Summary and next steps

- Calorimeter provides significant improvement in electron energy reconstruction in backward endcap
- This impacts choice of reconstruction method for certain kinematics
- Study more advanced reconstruction methods (kinematic fitting, ML)

- Have started looking at efficiency of simple E/p cut for eID
- eID must be supplemented by other detectors (particularly for $p < 2$ GeV)
- More advanced eID than "factorized" detector cuts?