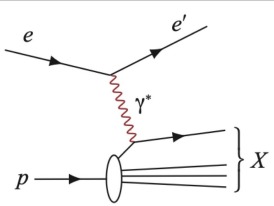


eID Discussion

Stephen Maple (U. Birmingham), Win Lin (SBU)

Inclusive PWG Meeting, 07/22/2026

UNIVERSITY OF BIRMINGHAM

Stony Brook University

Center for Frontiers in Nuclear Science

Performance and limitation of current method

"ReconstructedParticle Collection"

⇩

≥ 1 track & ≥ 1 cluster
Negatively charge

⇩

Isolated cluster:
$E_0/\Sigma E_{\delta R<0.7} > 0.9$

Basic

⇩

$0.8 < E/p < 1.2$

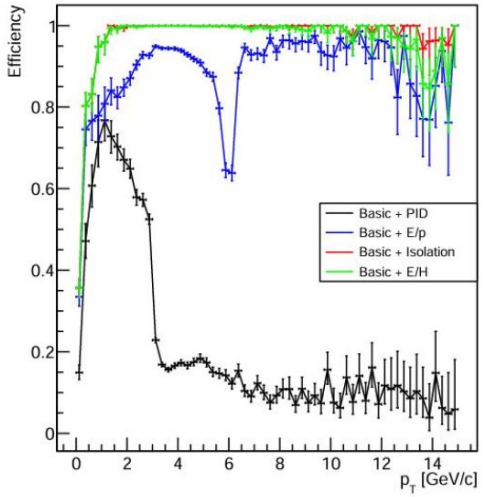
Other options?

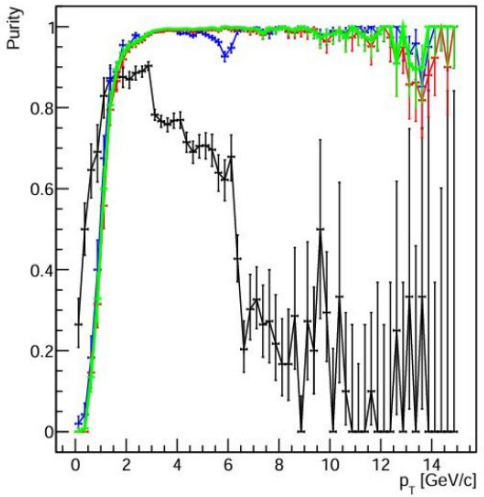
⇩

Highest p_T

- eID talk at collaboration meeting: link

Matilda Donlan (U. Birmingham) Details

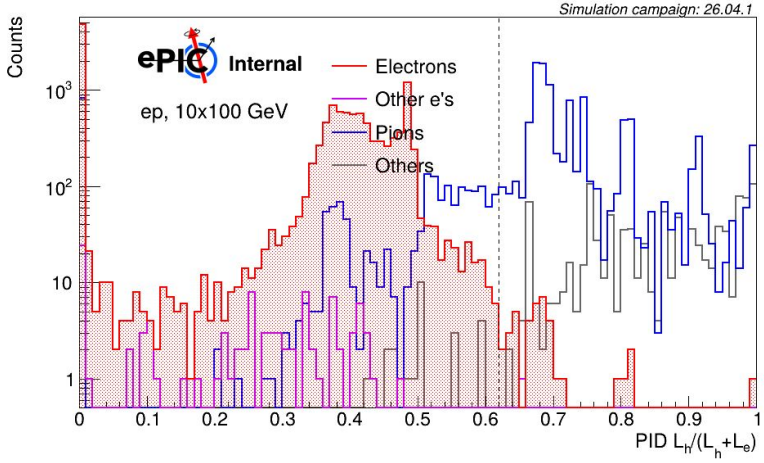




Q^2>10GeV^2
DIS only

- Promising initial results when considering PID -> low efficiency, but does increase purity at low p_t
  - Not ideal for cut based selection, but could prove valuable when moving to likelihood-based approach
- Improvement hard to see for ECAL-HCAL energy ratio -> test with other samples and as function of other variables

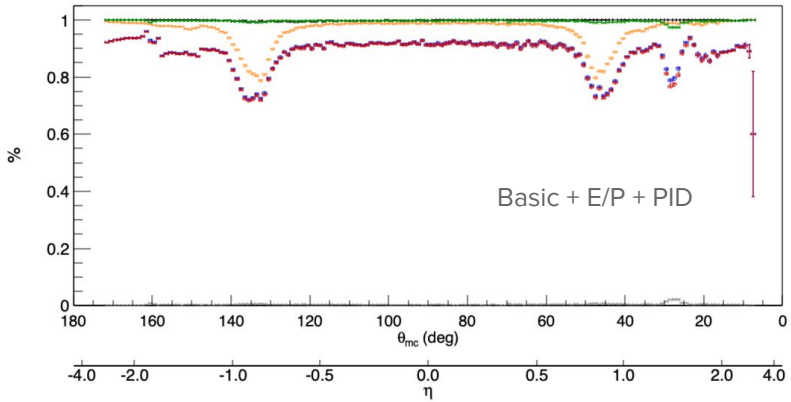
PID lookup table

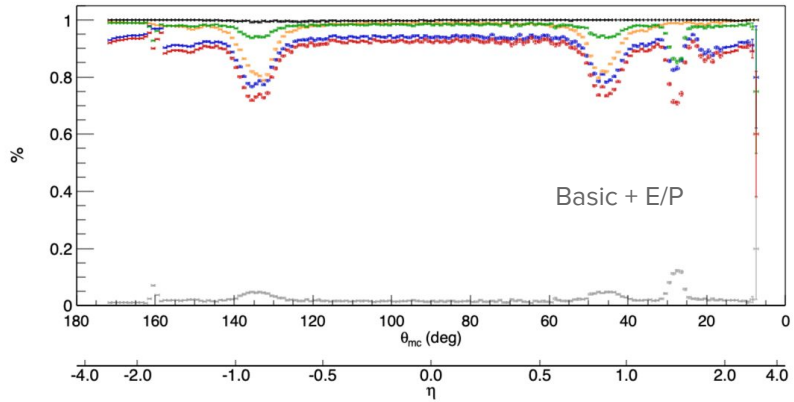


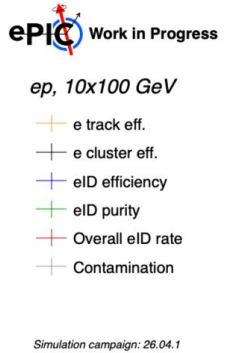
Lh: Max likelihood of being h+

Le: Max Likelihood of being e-

- Rate of success is low if we only consider the first prediction from PID LUT
- Calculate likelihood ratio from PID LUT accessed through “Reconstructed Particle” list
- Veto if $L_h / (L_h+L_e) > 0.62$

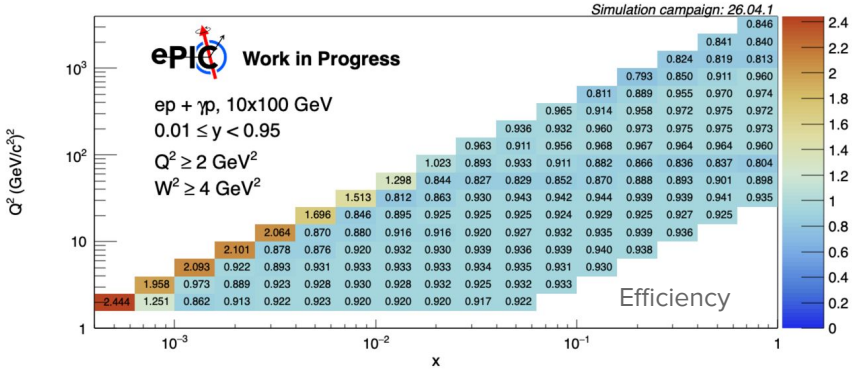


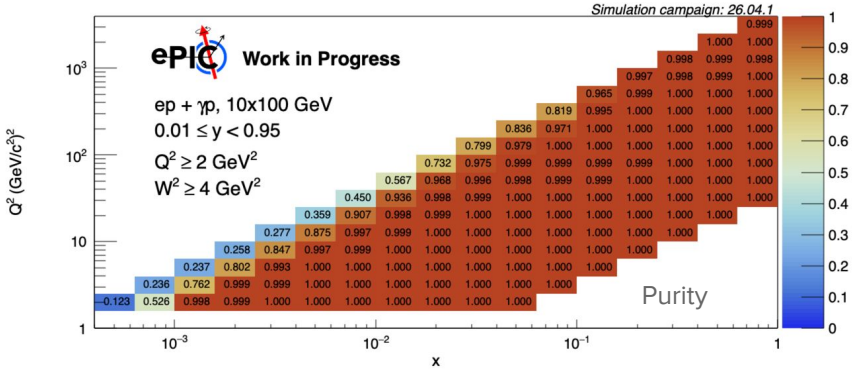




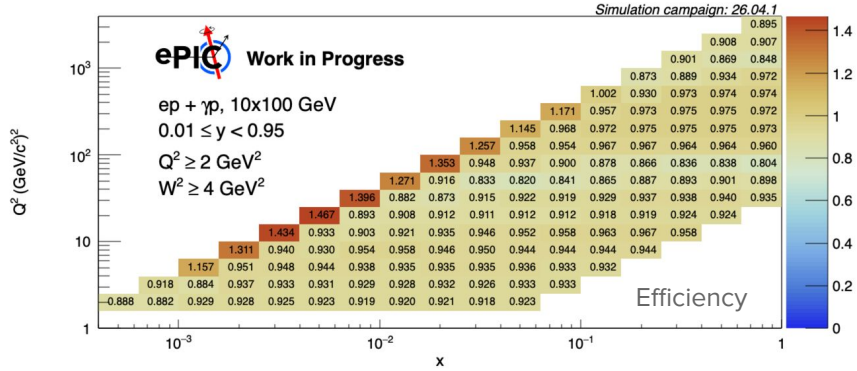
PID lookup table

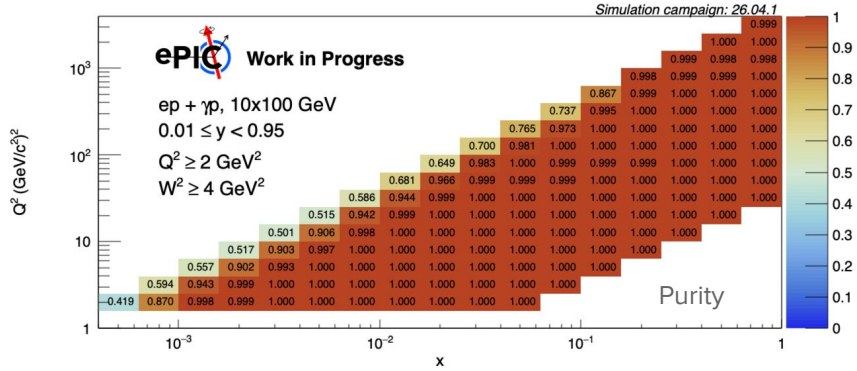
Basic + E/P + E-Pz



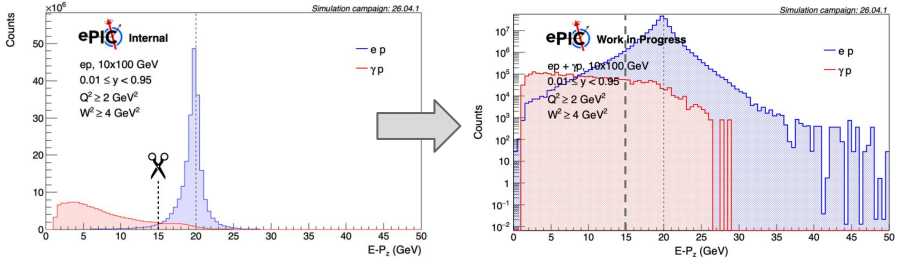


Basic + E/P + PID

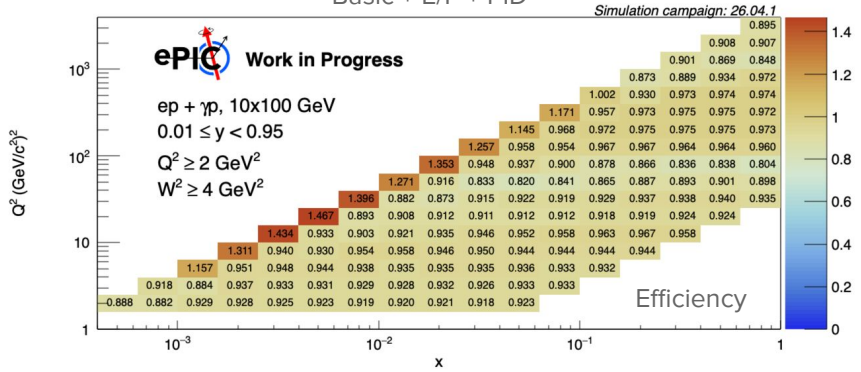


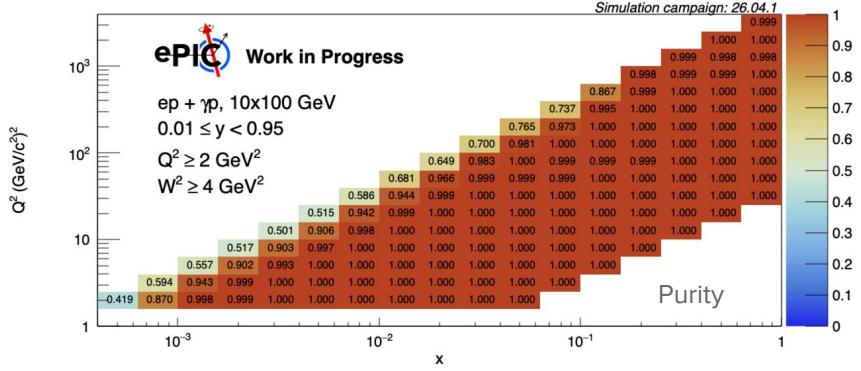


PID lookup table

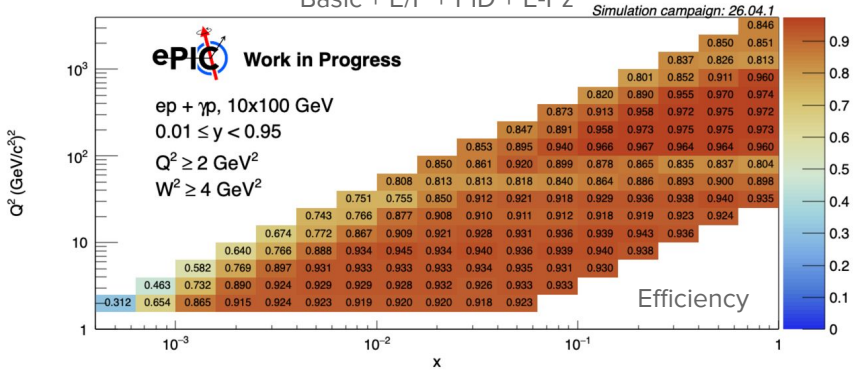


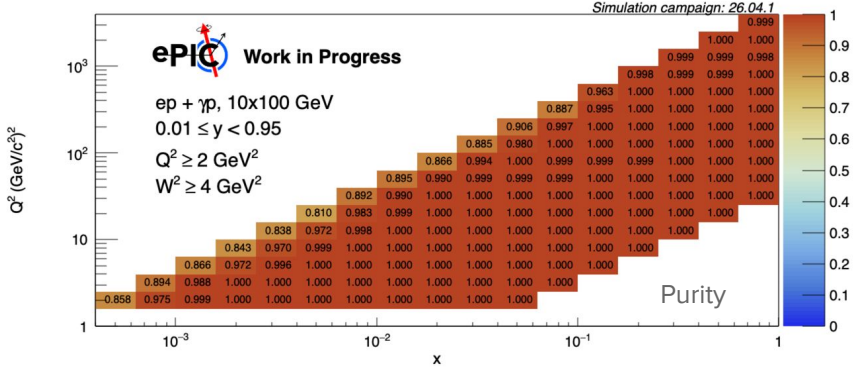
Basic + E/P + PID



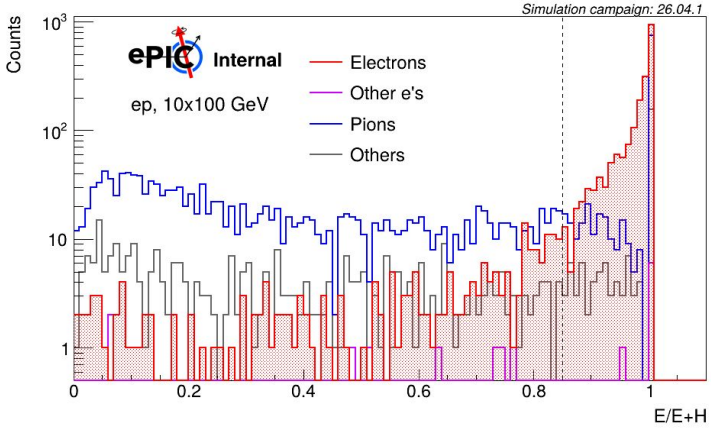


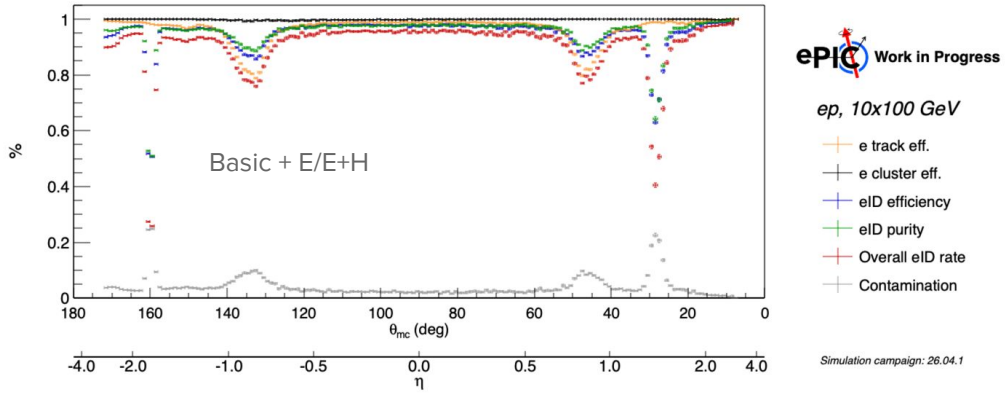
Basic + E/P + PID + E-Pz



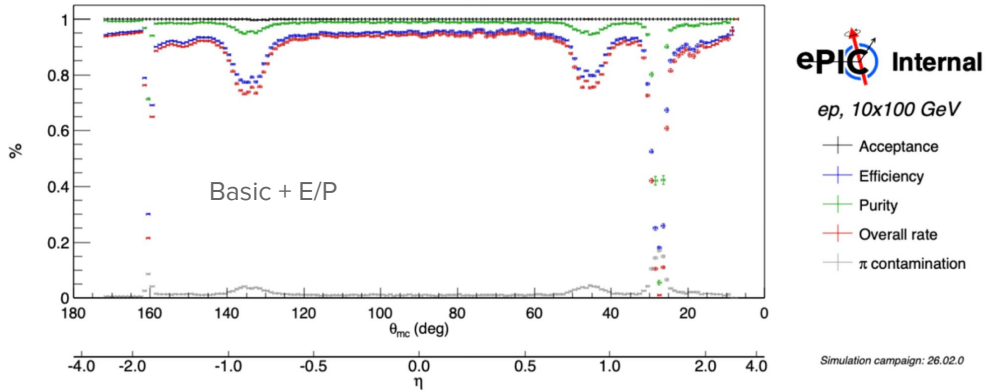


Cluster ratio E/E+H

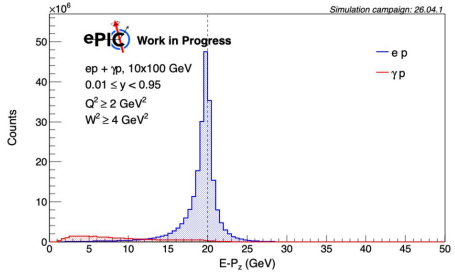




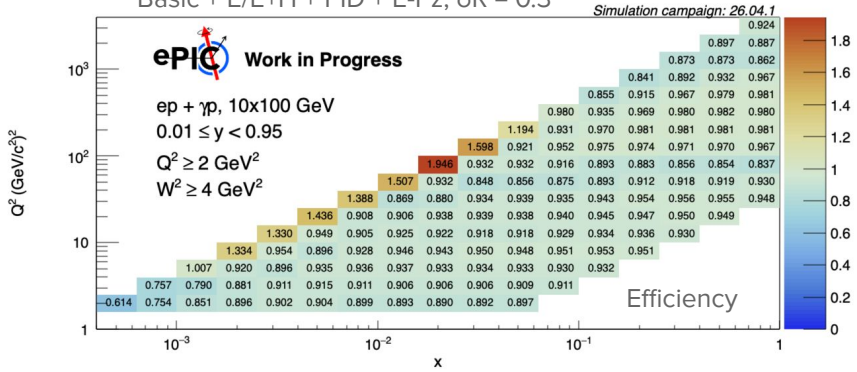
- δR = 0.7 for H cluster search
- Gives higher eID efficiency while keeping purity similar to Basic + E/P
- Better performance than Basic + E/P at small θ
- Does not help with the detector gap regions

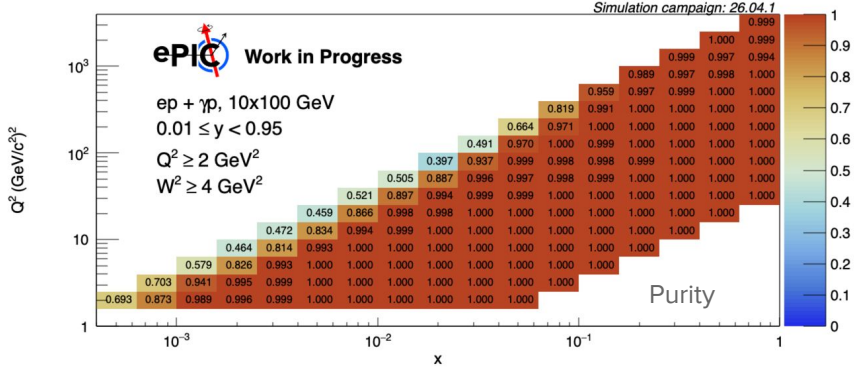


Cluster ratio E/E+H

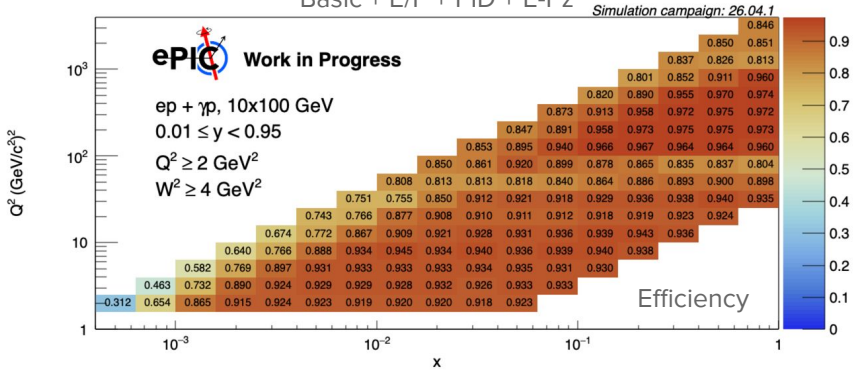


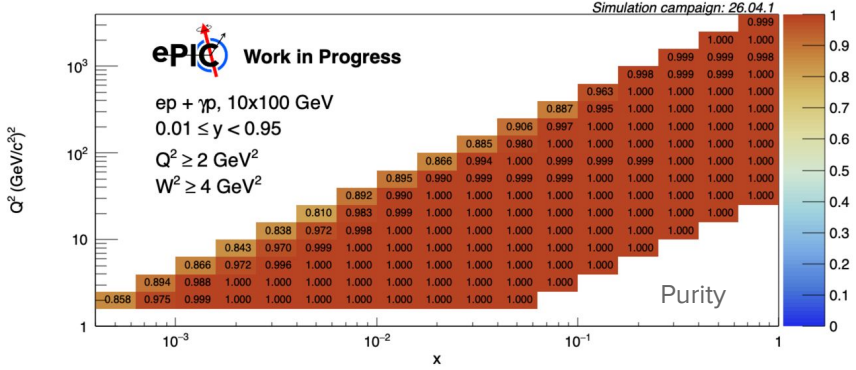
Basic + E/E+H + PID + E-Pz, δR = 0.3



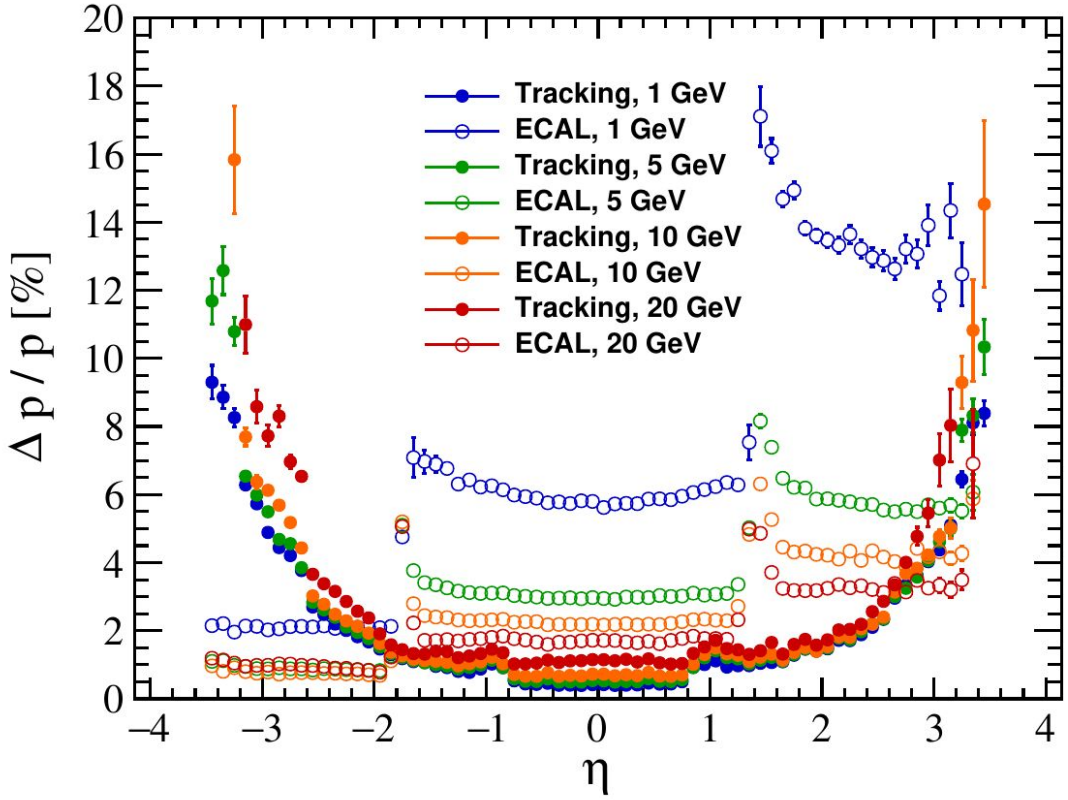


Basic + E/P + PID + E-Pz





Tracker vs Calorimeter Energy Resolution

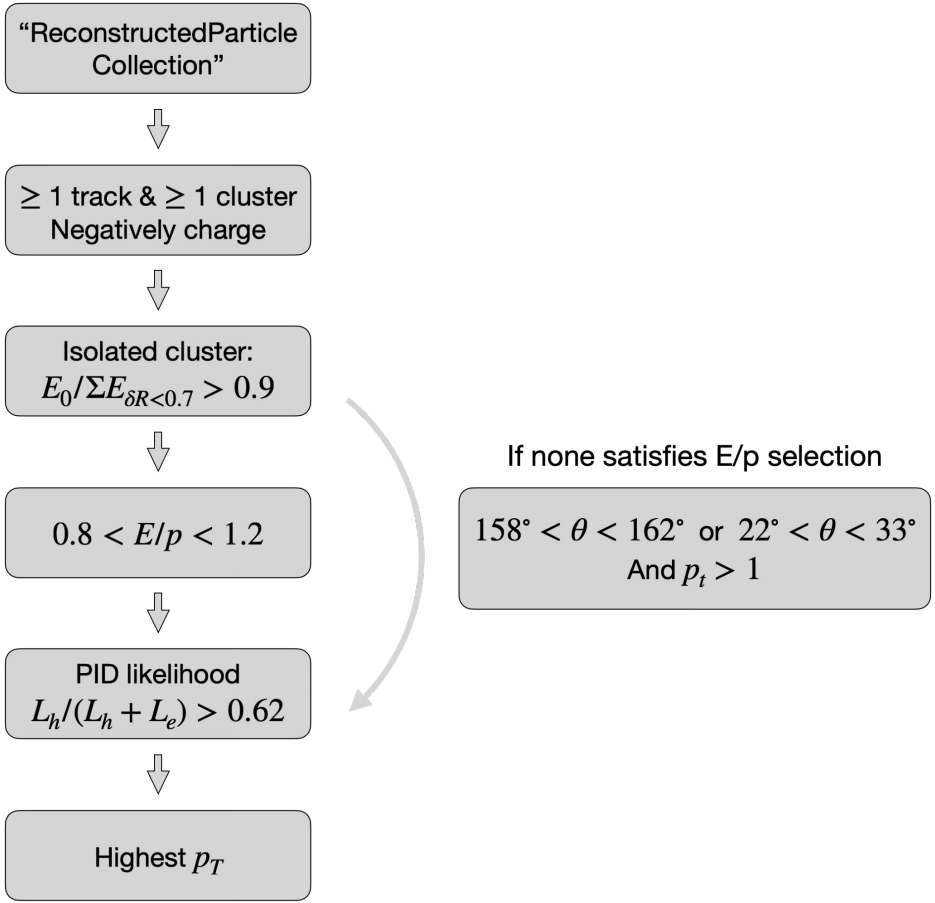


Resolution on E and p, and hence E/p varies with energy

- Tracking “energy” resolution degrades with increasing energy and |η|
- ECAL resolution shows weaker dependence on η, but strong dependence on energy
- Could use an η dependent E/p cut!

Generally: E_e better reconstructed by ECAL for η<-2.5, and tracker everywhere else

Proposed new cuts



Advertisement

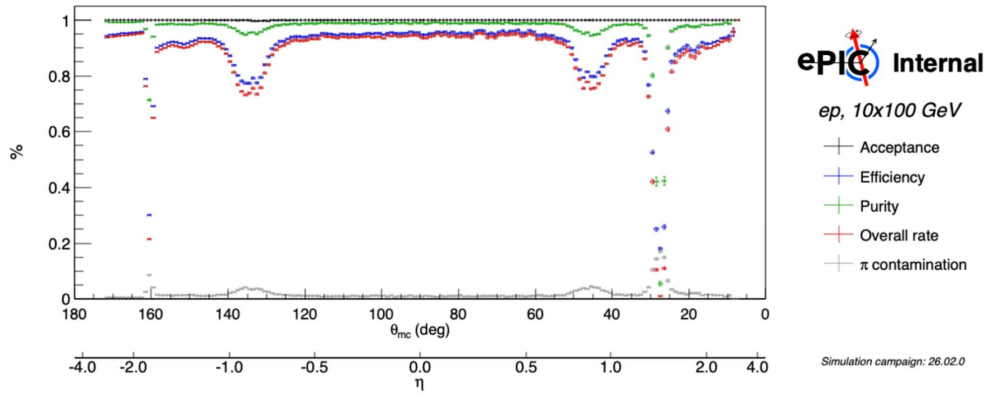
The 17th edition of the "International Conference on Meson-Nucleon Physics and the Structure of the Nucleon" (MENU 2026) is organized by the Center for Frontiers in Nuclear Physics and the Physics and Astronomy Department of Stony Brook University. It will be held at the Charles B. Wang Center.

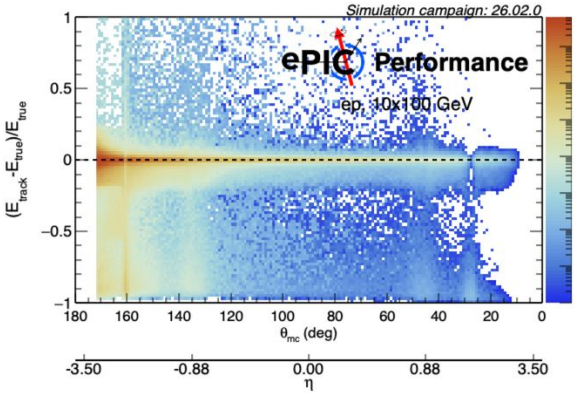
October 19th - 23rd, 2026

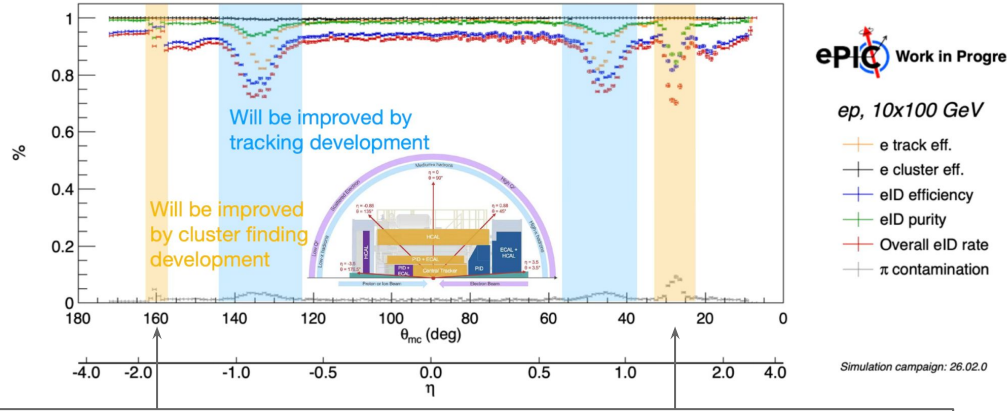
https://indico.cfnssbu.physics.sunysb.edu/event/668/overview

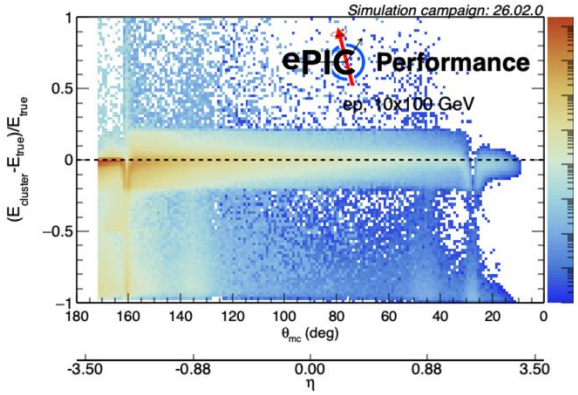
Backup

Performance and limitation of current method



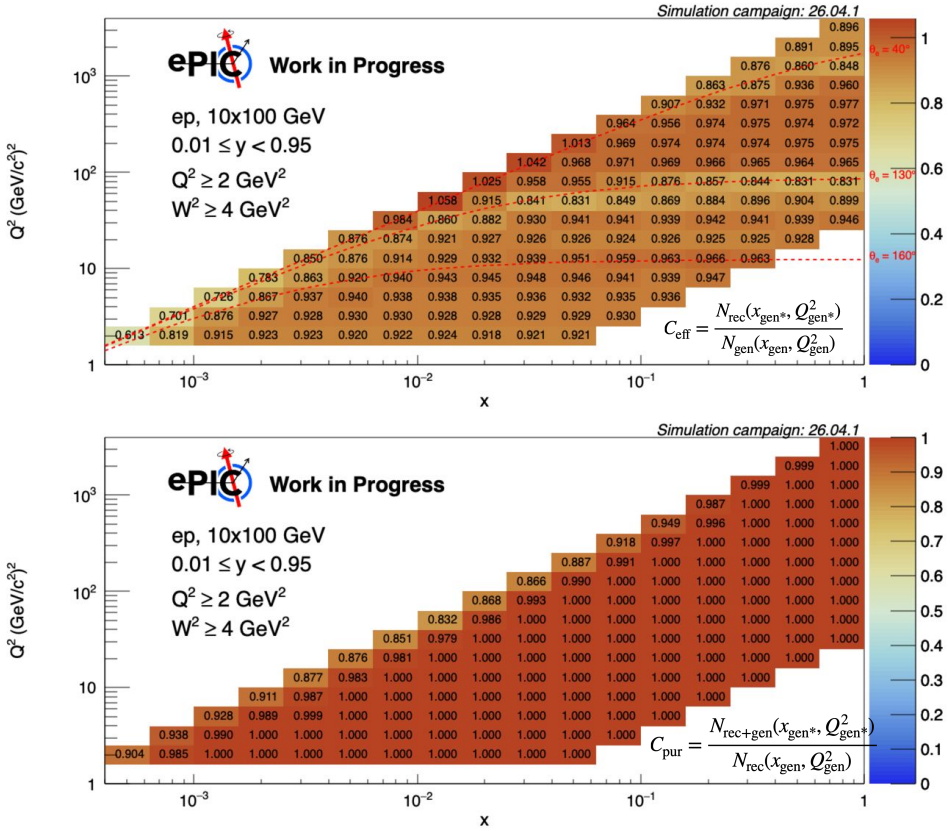






If found tracks in these regions, but no particles passed E/P cut for this event, then add these to candidate list

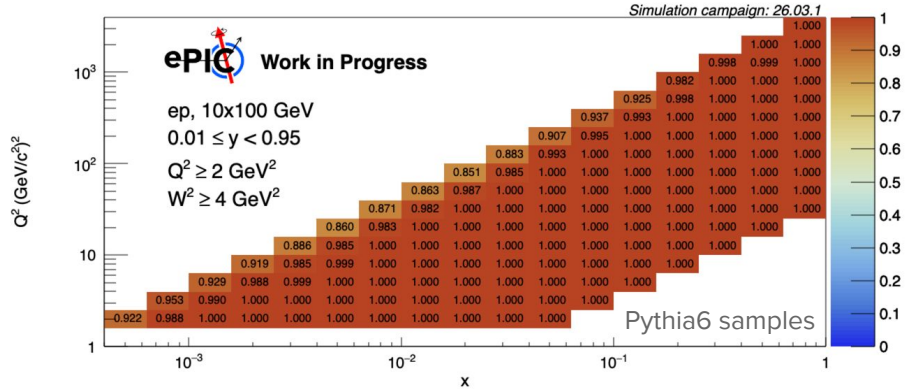
Performance and limitations of snippets eID

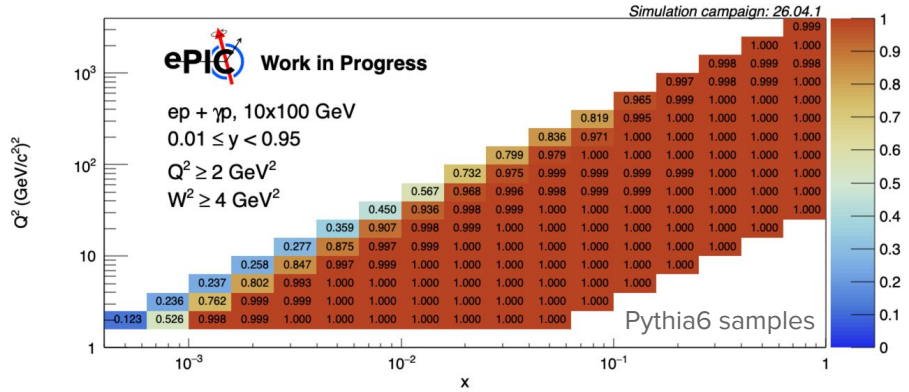


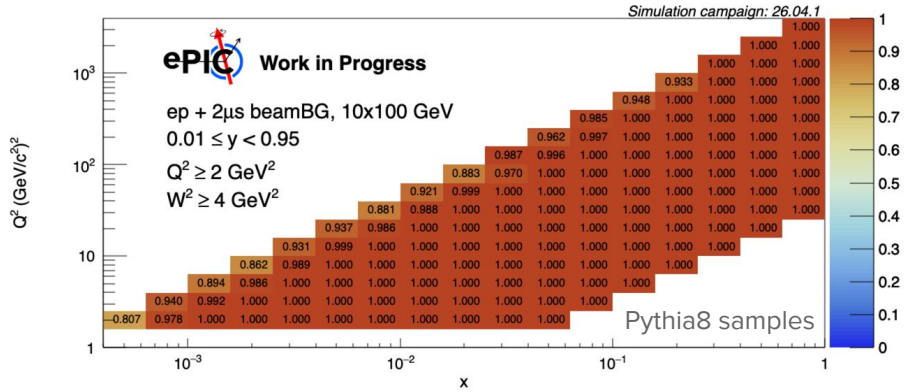
- Current algorithm largely driven by E/p and highest p_t selection
  - Requires efficient reconstruction of tracks and ECAL clusters
  - Also requires good resolution of for tracks and clusters in order to pass E/p cut
- Limited in that:
  - No E-H ratio
  - No PID detector info
  - No shower shape
- Also use pure cut-based approach -> aim to move to likelihood based (and for ML methods something like a BDT score)

$x_{\text{gen}*}, Q^2_{\text{gen}*}$ - for the scattered electron, this is calculated using MC info of the electron
- for the mis-identified particle, this is calculated by assuming it is the scattered electron and using its MC momentum

Impact of backgrounds







- **<u>Shown</u>**: changes in purity when low Q^2 events and beam background are added to DIS signal sample
- Impact mostly in the high y, low x region
- Corresponds to low energy electrons -> PID detectors may help here

$x_{\text{gen}*}, Q^2_{\text{gen}*}$ - for the scattered electron, this is calculated using MC info of the electron
- for the mis-identified particle, this is calculated by assuming it is the scattered electron and using its MC momentum