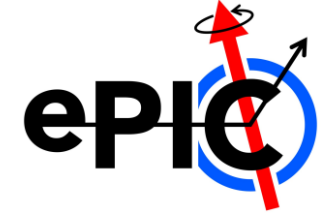
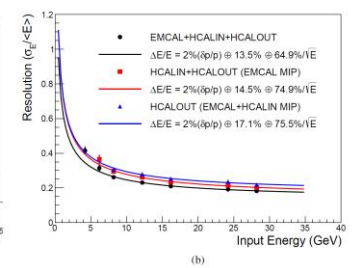
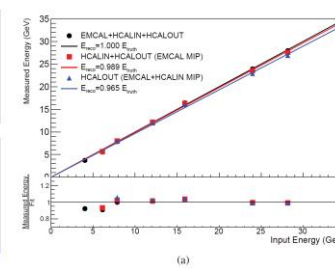
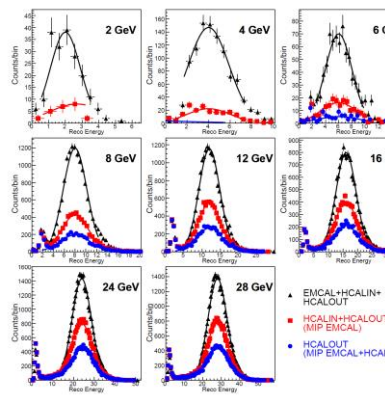
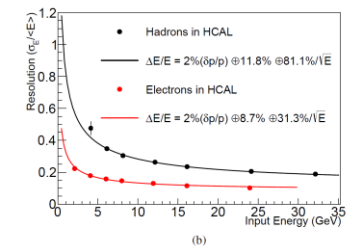
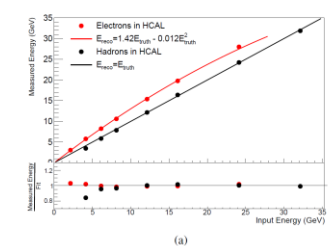
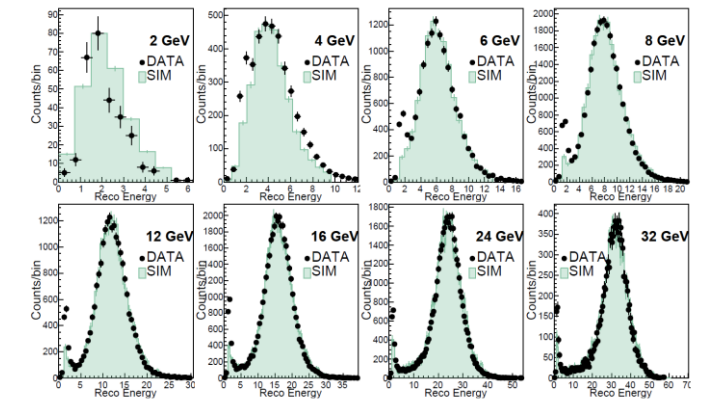
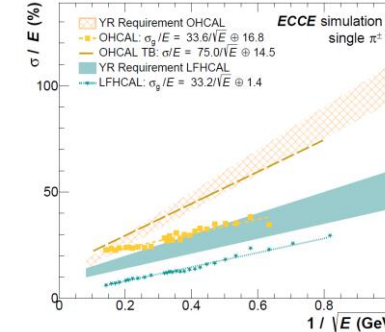
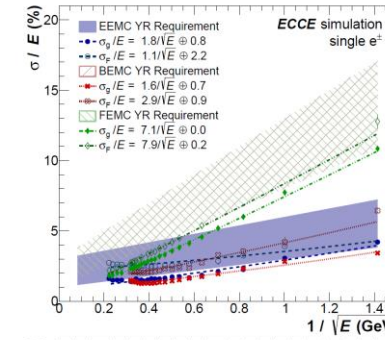


# ePIC BHCAL Meeting | Possible TDR Plots (1/2)



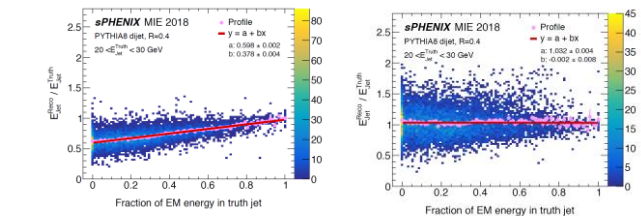
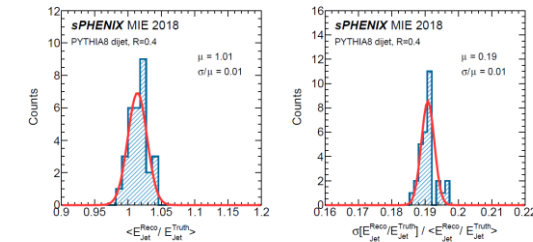
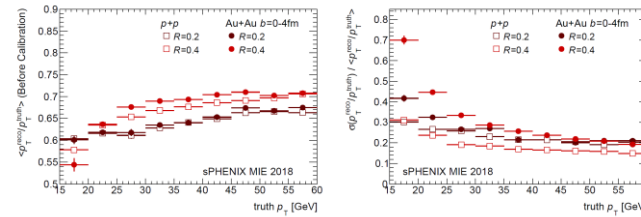
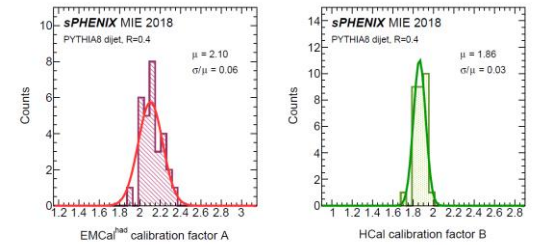
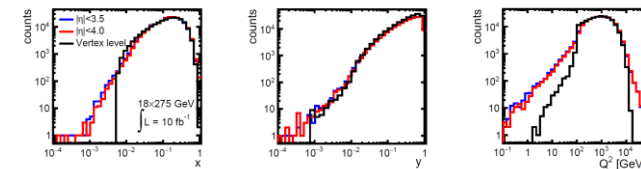
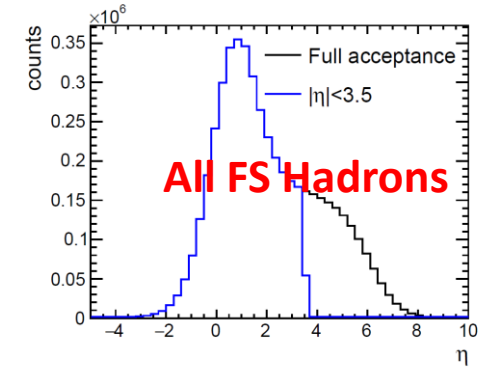
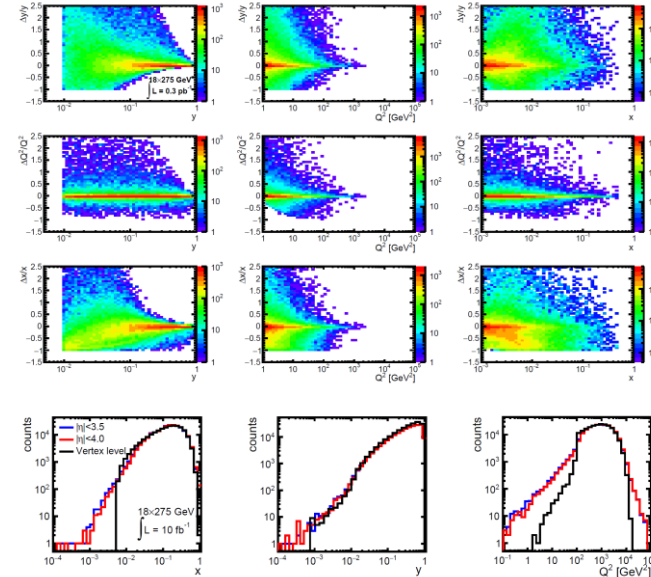
- **Single Particle:** do we meet YR requirements?
  - **Plots:** reconstructed particle energy; resolution + linearity
    - ›  $\pi^\pm, n^0 (p^+, k_L^0?)$
    - › Calibrated, uncalibrated
      - ↳ BHCAL + BIC, HCal only
      - ↳ Single tile vs. multi-tile? (1, 2, 3, 4, 5 tiles?)
  
- **Single – Few Particles:** do we help with  $\mu^\pm$  ID?
  - **Plots:**  $\mu^\pm$  energy; reconstruction efficiency; non- $\mu^\pm$  rejection factors
    - ↳ Andrew Hurley at UMass Amherst has started looking at  $\mu^\pm$  ID in the Barrel
  
- **Right:** reference plots from ECCE proposal (upper left) and sPHENIX Test Beam Paper (all others)



# ePIC BHCAL Meeting | Possible TDR Plots (2/2)



- **Event Reconstruction 1:** do we help with JB?
  - **Plots:** true vs. reco.  $x_{JB}, y_{JB}, Q_{JB}^2$ 
    - › w/ vs. w/o BHCAL?
- **Event Reconstruction 2:** do we help with CC DIS tagging?
  - **Plots:** true vs. reco.  $E_T^{miss}$ 
    - › w/ vs. w/o BHCAL?
    - › NC vs. CC DIS?
- **Jet Reconstruction:** do we improve the JES/JER?
  - **Plots:** JES/JER
    - › w/ vs. w/o BHCAL?
    - › Calibrated vs. uncalibrated?
- **Right:** reference plots from EIC YR (upper 3) and sPHENIX TDR (all others)



**Note:** “vertex level” = truth level

# ePIC BHCaI Meeting | Thinking Through Plots (1/2)



- **Note:** some ideas might be better suited for the physics paper rather than the TDR
  - Also, several plots have synergy with other DSCs or PWGs
  - **Red** = plots critical for TDR, **blue** = maybe for physics paper
- **Single particle: energy spectra** (uncalibrated vs. calibrated), and **linearity/resolution**
  - Machinery in place
    - › Could stand a couple improvements...
    - › e.g. setting up macros to run on campaign output rather than as a plugin
  - ML part of calibration needs tuning (esp. for neutrons)
- **Single particle: (cont.)**
  - **Varying no. of tiles challenging:**
    - a) Need to rerun EICrecon for each combination of tile
    - b) Then would run calibration/plotting macros on output from each
- **Muons: reconstruction efficiency**
  - We should reach out to Andrew Hurley:
    - ☞ He's carried out fairly extensive studies of muon ID in the barrel

# ePIC BHCAL Meeting | Thinking Through Plots (2/2)



- **Jet reconstruction: JES/JER**
  - Needs quite a bit of development, though
    - › Won't be able to use campaign output (HCal not used in jets yet)
    - › And we'll need EMCal-HCal calibration factors...
      - ☞ Could extend ML study: train on jets rather than clusters...
      - ☞ Good to have non-ML option available as well (e.g. ch. 8 of sPHENIX TDR)
  - Possible intermediate plots:
    - 1) Jet energy vs. eta
    - 2) Fraction of EM vs. hadronic energy
      - ☞ Functionality is available to do basic track-matching
    - 3) Calibration factors
- **Jet reconstruction: (cont.)**
  - 4) EM energy fraction vs. jet energy
  - 5) And finally, JES/JER
  - Additional thoughts:
    - › I think the relevant scale to calibrate against would  $Q^2$ ...
    - › Also would be good to explore asymmetric jet algorithm (e.g. Centauro)
- **Event reconstruction: JB variables,  $E_T^{miss}$** 
  - Algorithmically, very easy to calculate (sum over all hadron energies)
    - › But need to avoid double-counting...
    - › So need PF (or calibration factors?)



# Backup | JB Variables & More Reference Plots

- **Jacquet-Blondel (JB) Kinematic Variables:** i.e. reconstructed event kinematics using only the hadronic final state

$$- y_{JB} = \frac{\sum_h (E_h - p_{z,h})}{E_{beam}^e}$$

$$- Q_{JB}^2 = \frac{(\sum_h p_{x,h})^2 + (\sum_h p_{y,h})^2}{1 - y_{JB}} = \frac{(E_T^{miss})^2}{1 - y_{JB}}$$

$$- x_{JB} = \frac{Q_{JB}^2}{s y_{JB}}$$

- **Upper Right:** reference plot for generated vs. reconstructed  $E_T^{miss}$  (from [arXiv:2006.1520](https://arxiv.org/abs/2006.1520))
- **Lower Right:** reference plot for JES/JER with vs. without HCal's (from EIC YR)

