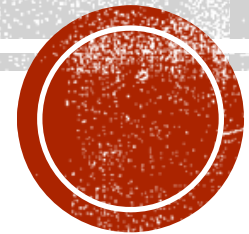


New calibration figures for pre-TDR

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OVERVIEW

- New figures for preTDR
 - Calibrations for π^+ , π^- , and neutrons using the **latest simulation campaign**
- Comparison to the previous figures
 - Discussion of changes

MANUAL CALIBRATION METHOD

- Single particle calibrations
 - **New version with latest simulation campaign (26.05.0)**
 - Have all particles from pre-TDR: π^+ , π^- , and neutrons
- All presented calibrations use Method 2
 - Currently the only verified calibration method
 - $E_{calib} = A(E_{EMCAL} + BE_{bHCAL})$
 - Plot $(E_{EMCAL} + BE_{bHCAL})/E_{par,MC}$
 - First find B for which the distribution above has the smallest σ/μ
 - A is set as $1/\text{mean}$ of the distribution with optimal B

FIG. 3.194 (OLD)

- Uncalibrated energy deposition in bHCAL for π^+ and π^-
 - **Uses bHCAL only simulation configuration:** Is this useful?
 - **Uses leading bHCAL clusters:** Do we trust current clustering?
- All calibrations and energy reconstruction will be done using bECAL+bHCAL system
- Additional smearing primarily from solenoid
 - Replace by bECAL+bHCAL without magnet and then compare to full detector simulation in Fig. 3.195?

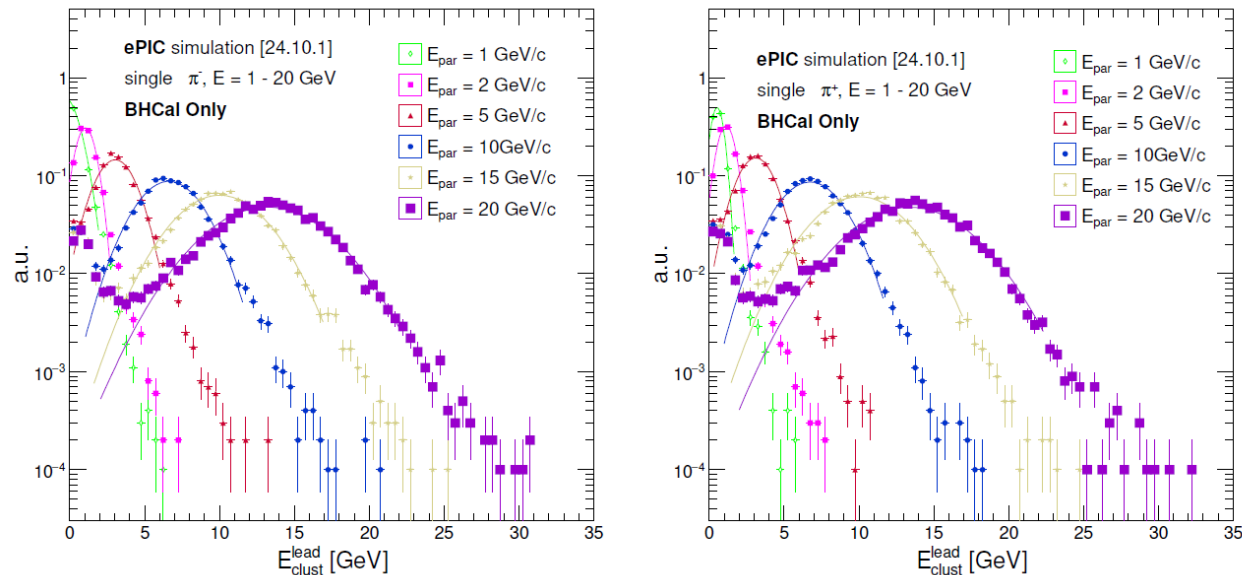


FIG. 3.195 (OLD)

- Uncalibrated energy deposition in bHCAL leading clusters for π^- (top left) and π^+ (top right)
- Calibrated energy in bHCAL leading clusters for π^- (left) and π^+ (right) using two ML methods from ROOT TMVA package
 - (middle) Linear-Discriminant (LD)
 - (bottom) Multi-Layer Perceptron (MLP)
- Uses leading bHCAL clusters

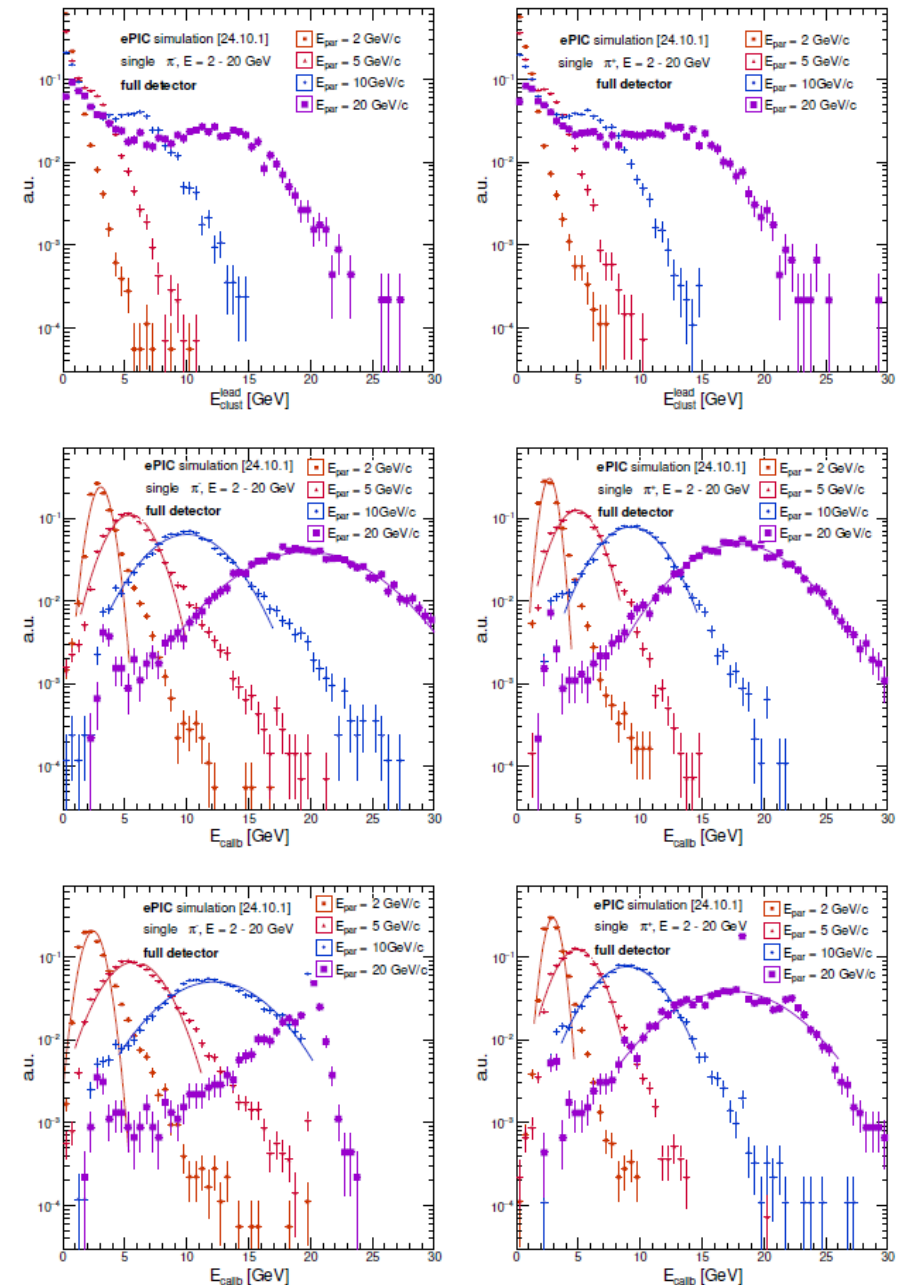


FIG. 3.195 (NEW)

- Uncalibrated energy deposition in bECAL+bHCAL hits for π^- (top left) and π^+ (top right)
- Calibrated energy for bECAL+bHCAL hits for π^- (left) and π^+ (right) using Method 2 manual calibration method
- **Key changes:**
 - Using bECAL (SciFi) and bHCAL hits rather than clusters to avoid clustering
 - Focus on lower energies
 - Manual calibration using information from tracking
- **Notes:**
 - Low energy shoulder shape (Slide 6)?

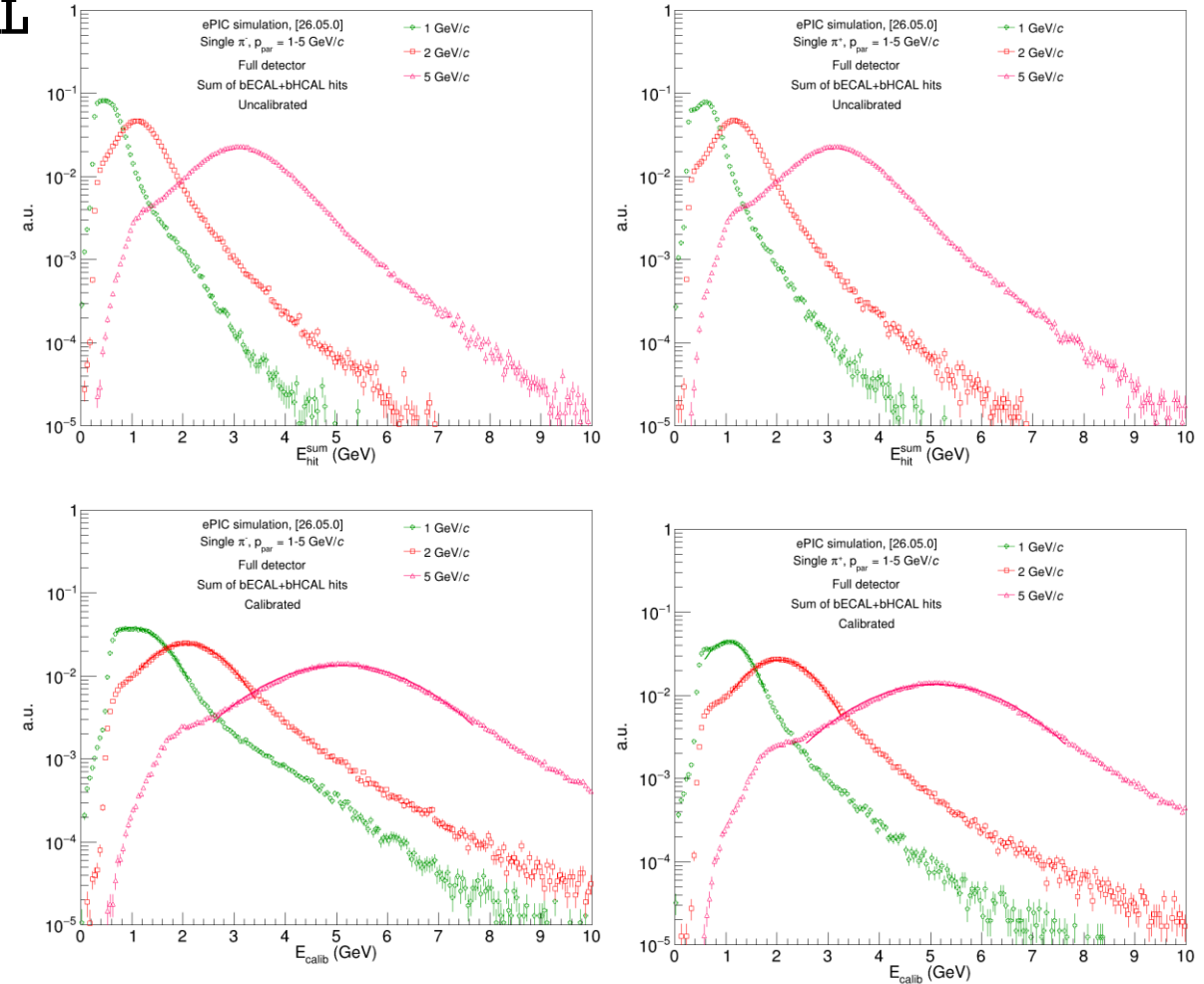


FIG. 3.195 (NEW)

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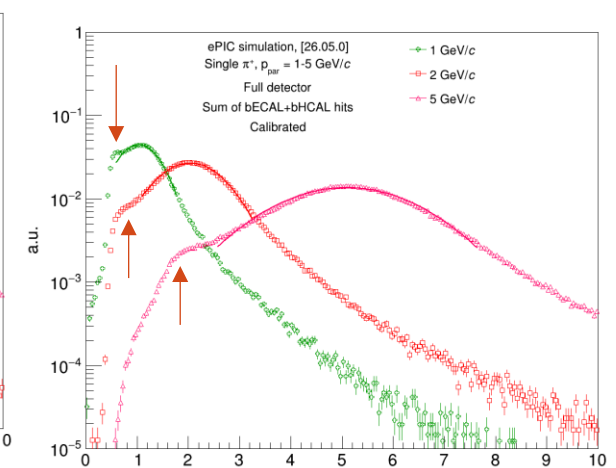
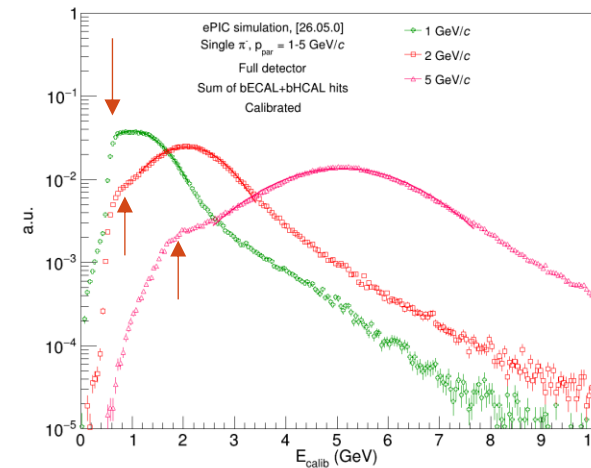
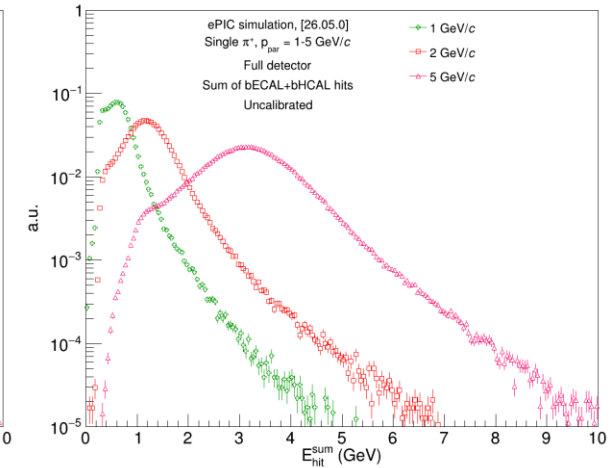
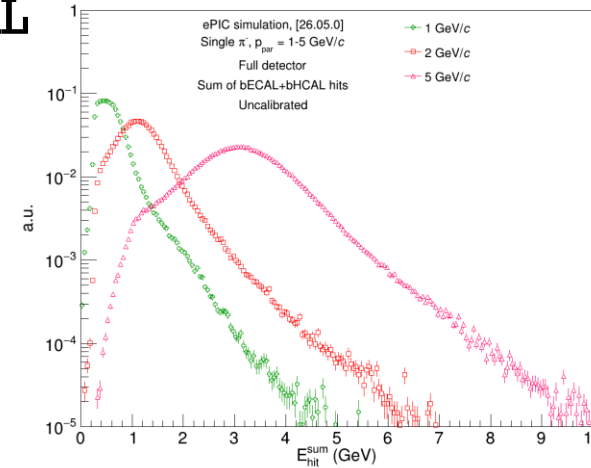


FIG. 3.196 (OLD)

- Calibration results for π^- (left) and π^+ (right) using two ML methods from ROOT TMVA package
 - (top) Comparison of uncalibrated and calibrated energy
 - (bottom) Energy resolution
- Uses leading bHCAL clusters

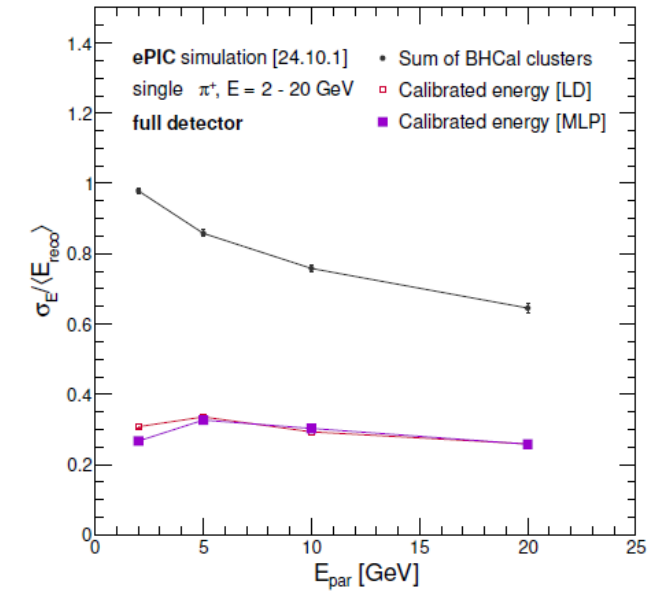
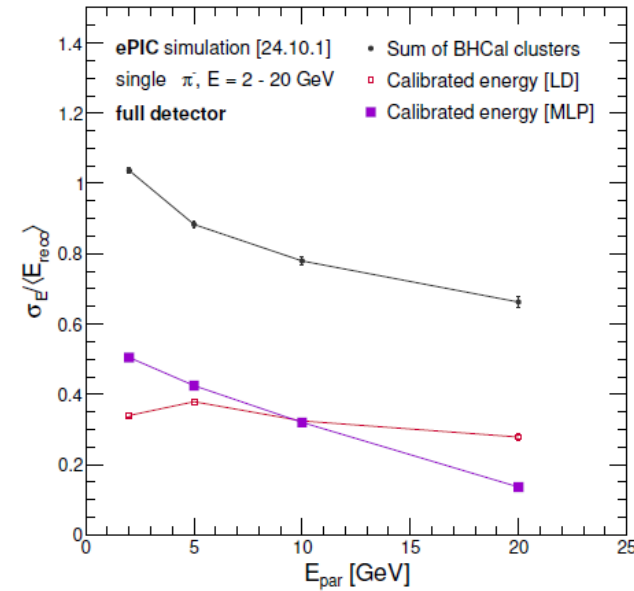
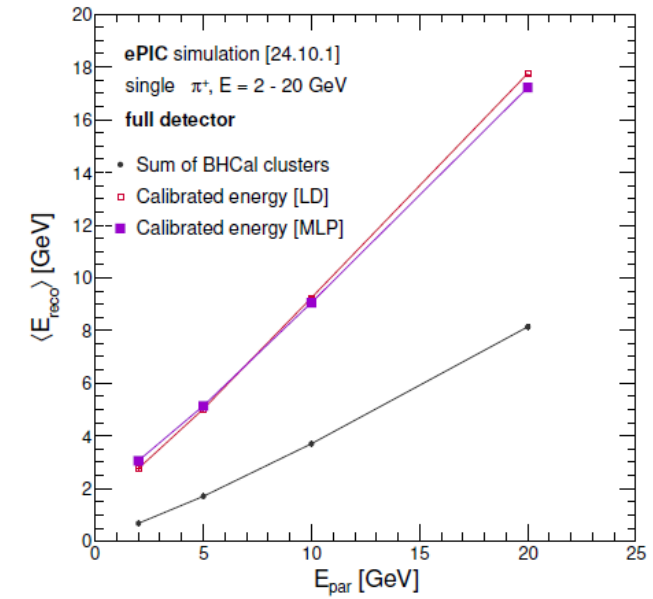
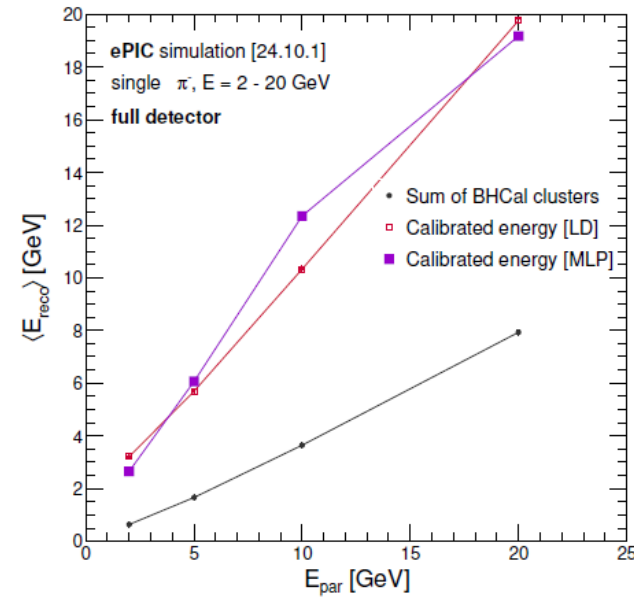


FIG. 3.196 (NEW)

- Calibration results for π^- (left) and π^+ (right) using Method 2 manual method
 - (top) Comparison of uncalibrated and calibrated energy
 - (bottom) Energy resolution
- **Key changes:**
 - Using bECAL (SciFi) and bHCAL hits rather than clusters to avoid clustering
 - Focus on lower energies
 - Manual calibration using information from tracking
- **Notes:**
 - Worse performance for π^-

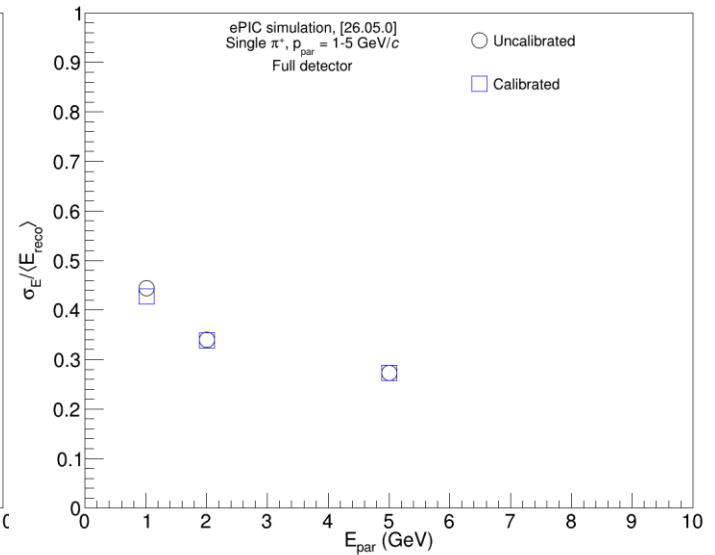
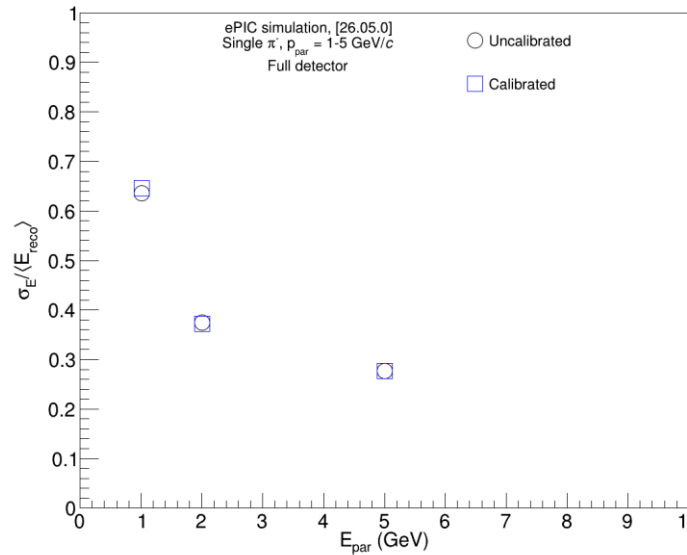
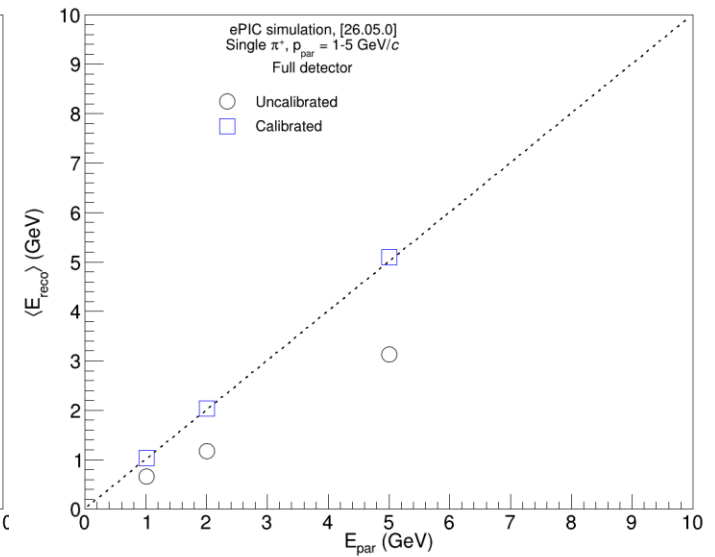
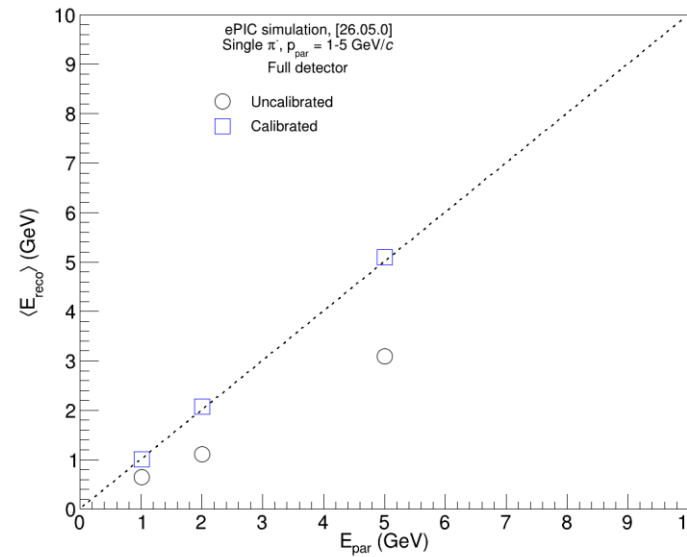


FIG. 3.197 (OLD)

- Uncalibrated energy deposition in bHCAL leading clusters for neutrons (top left)
- Calibrated energy in bHCAL leading clusters for neutrons using two ML methods from ROOT TMVA package
 - (top right) Linear-Discriminant (LD)
 - (bottom) Multi-Layer Perceptron (MLP)
- Uses leading bHCAL clusters

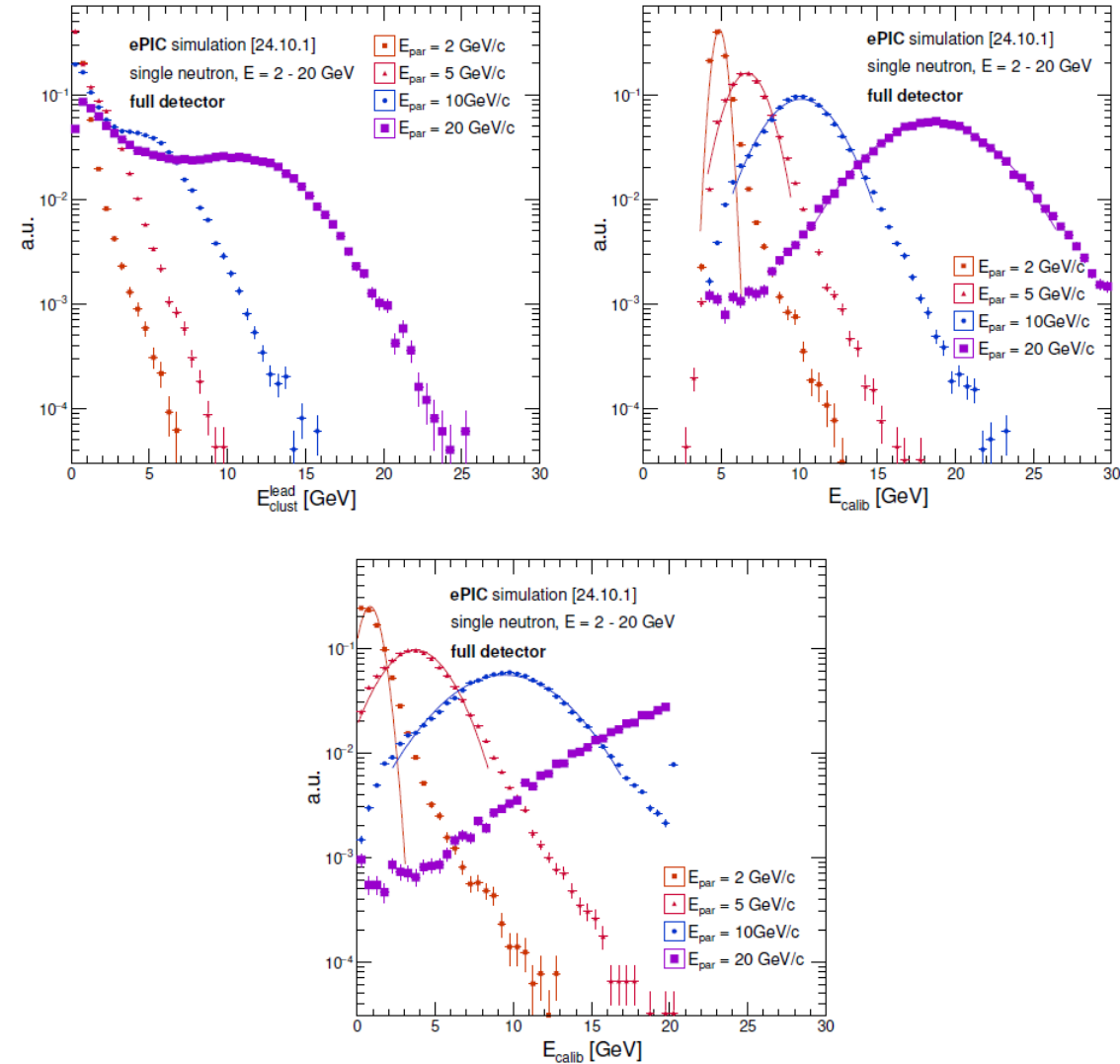


FIG. 3.197 (NEW)

- Uncalibrated energy deposition in bECAL+bHCAL hits for neutrons (top)
- Calibrated energy for bECAL+bHCAL hits for neutrons using Method 2 manual calibration method (bottom)
- **Key changes:**
 - Using bECAL (SciFi) and bHCAL hits rather than clusters to avoid clustering
 - Focus on lower energies
 - Manual calibration using information from MC

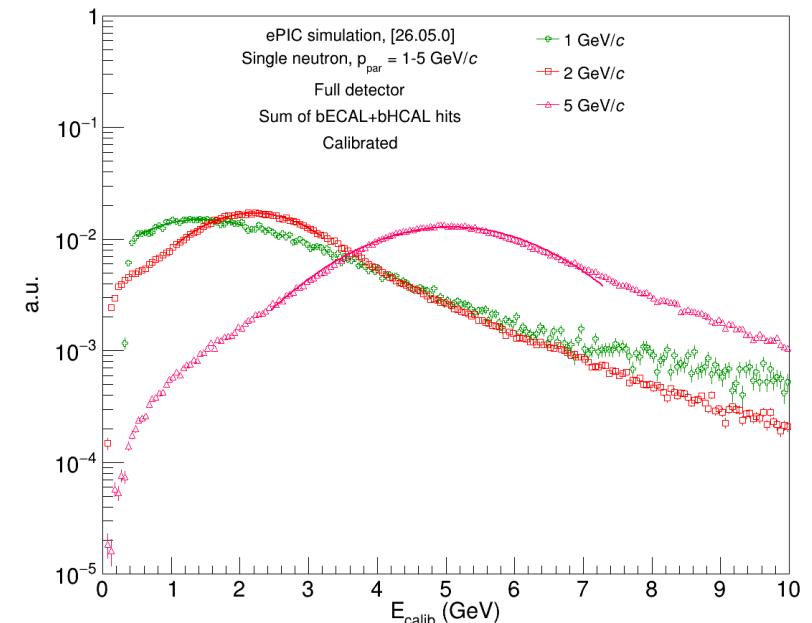
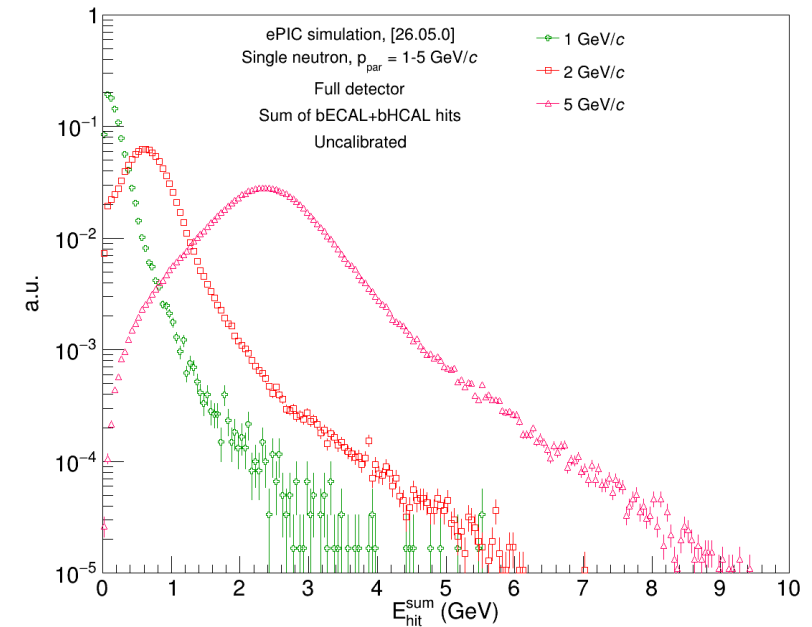


FIG. 3.198 (OLD)

- Calibration results for neutrons using two ML methods from ROOT TMVA package
 - (left) Comparison of uncalibrated and calibrated energy
 - (right) Energy resolution
- **Uses leading bHCAL clusters**

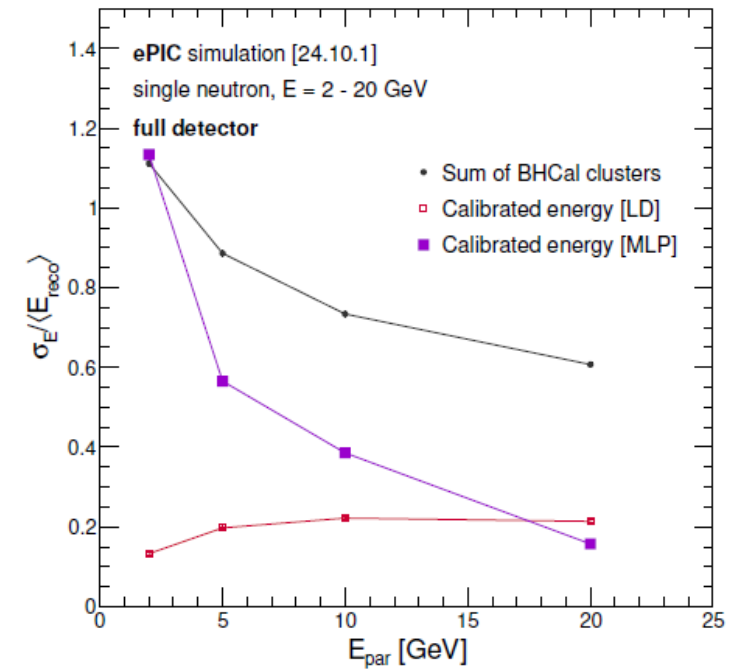
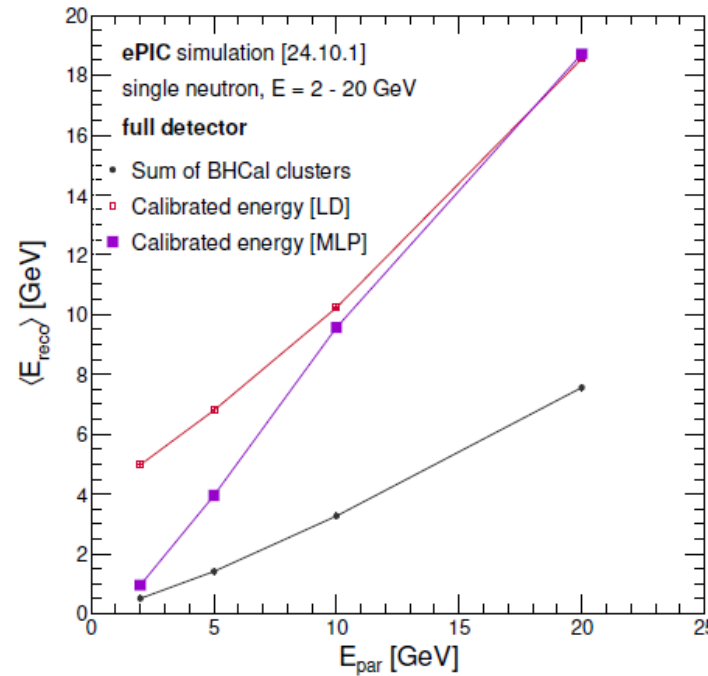


FIG. 3.198 (NEW)

- Calibration results for neutrons using Method 2 manual method
 - (top) Comparison of uncalibrated and calibrated energy
 - (bottom) Energy resolution
- **Key changes:**
 - Using bECAL (SciFi) and bHCAL hits rather than clusters to avoid clustering
 - Focus on lower energies
 - Manual calibration using information from MC

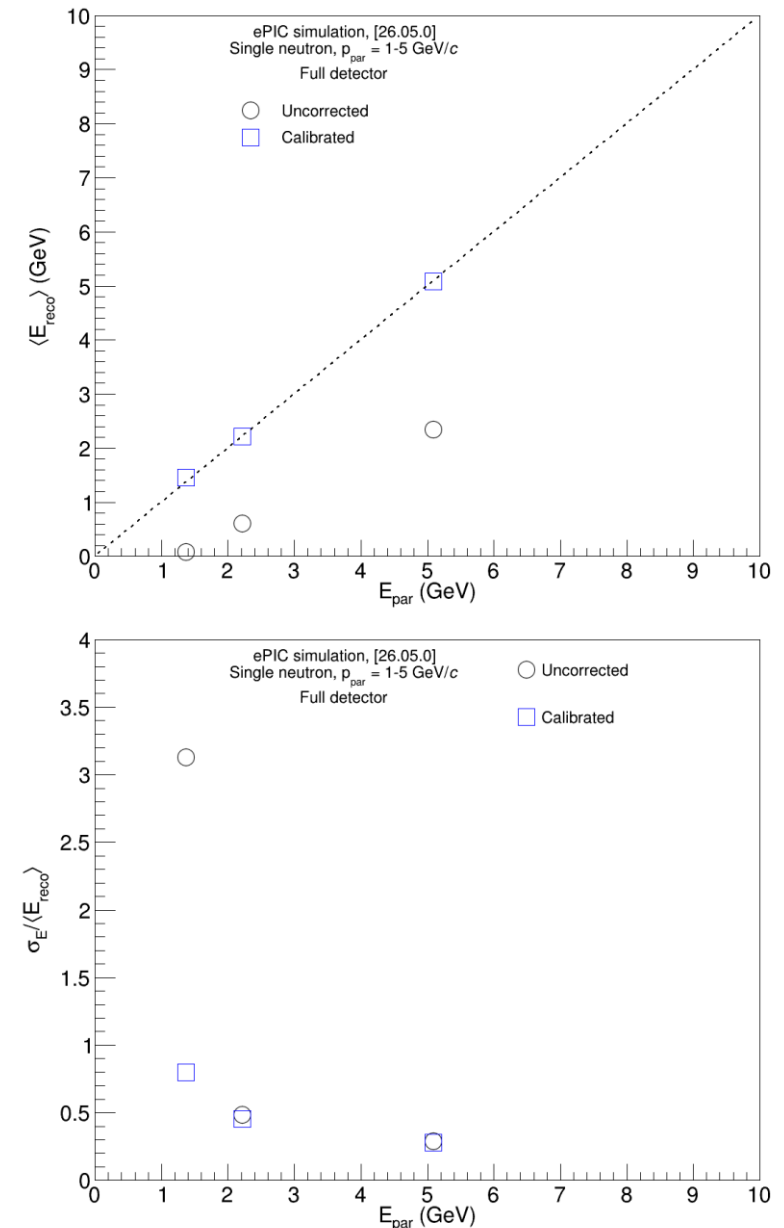
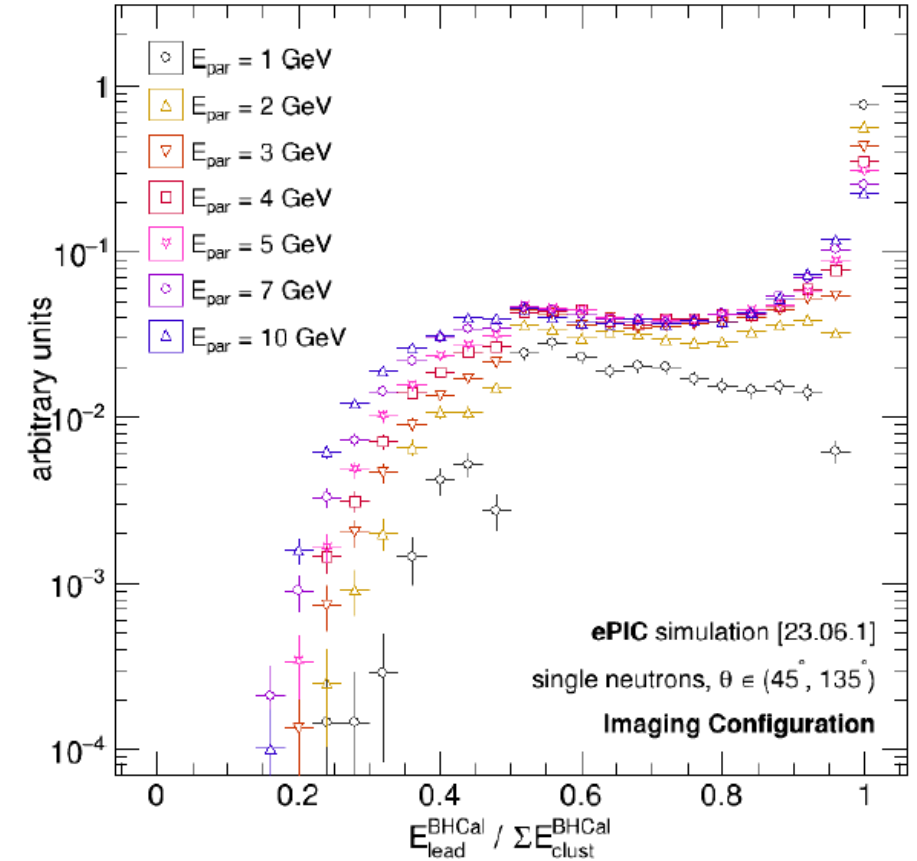


FIG. 3.199 (OLD)

- Comparison of energy deposition in leading bHCAL cluster and all bHCAL clusters for single neutrons
- Do we want this figure re-produced?
 - How much do we trust the current clustering implementation?



SUMMARY AND OUTLOOK

- Produced new version of updated plots for pre-TDR
 - **Simulation campaign 26.05.0**
 - Finished for all particles used for old figures
 - π^+ , π^- , and neutrons
 - Method 2 manual calibration
 - Using tracking information for π^+
 - Using MC information for neutrons
- **Outlook:**
 - Investigating origin of secondary peak structure at low energy for π^+ and π^-
 - Possibly connected to different resolution at low energy between π^+ and π^-
 - Ongoing study on energy depositions in individual layers of barrel calorimetry system
 - Imaging ECAL, SciFi ECAL, bHCAL
 - Hits vs. clusters
 - Magnet

THANK YOU FOR ATTENTION