

# **bHCAL Meeting — Neutron Calibration Update**

Jan Vanek

University of New Hampshire

07/27/2026



# OVERVIEW

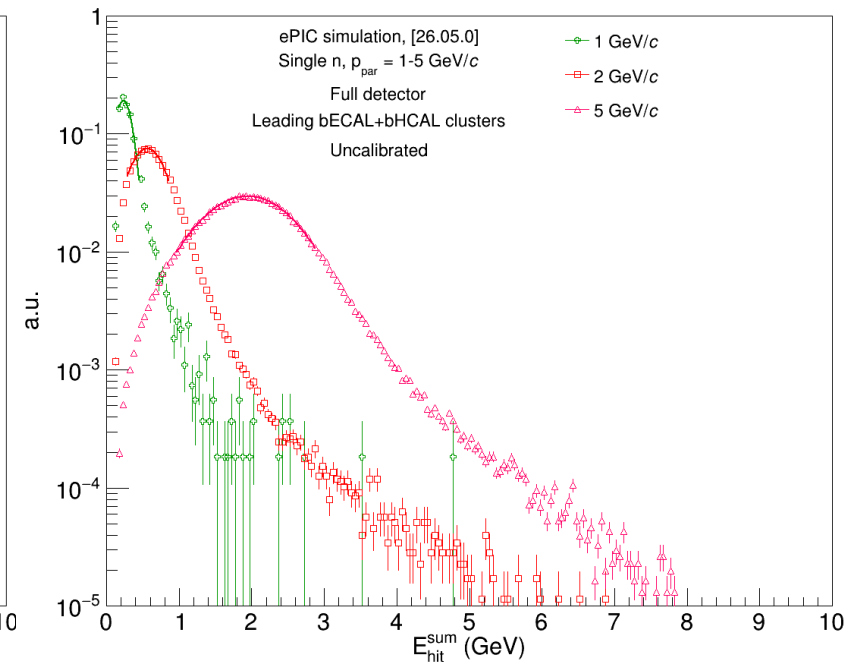
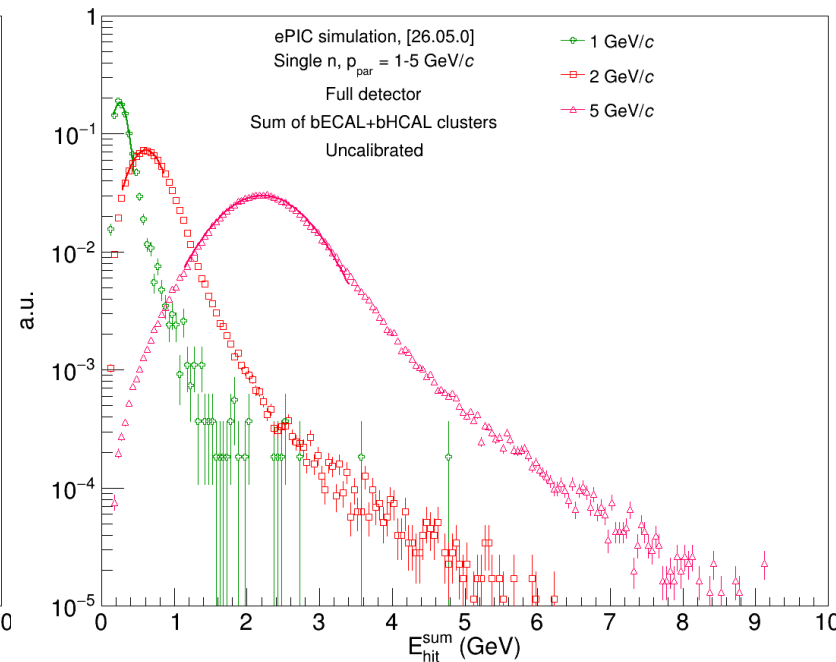
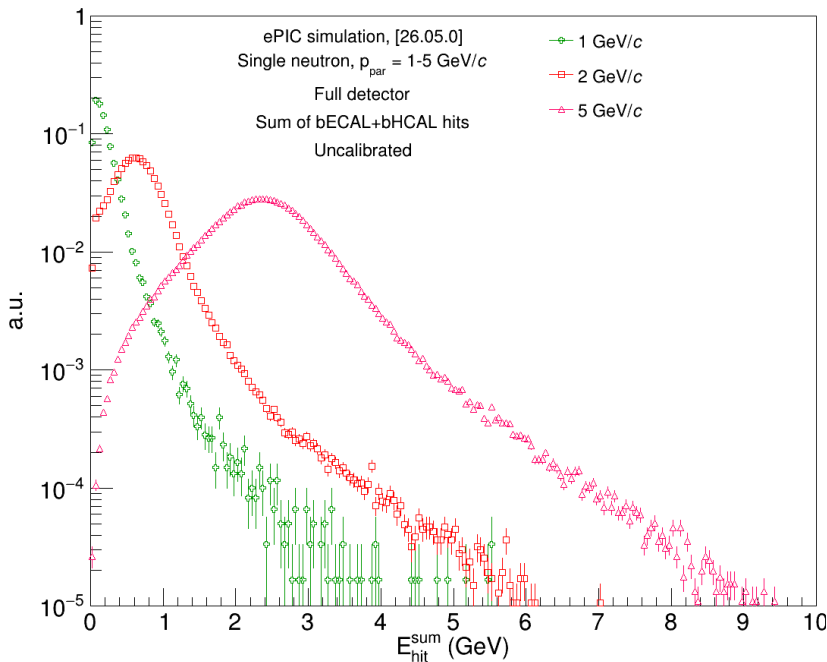
- Calibration using clusters
  - Method 2 calibration using energy deposition from clusters
  - More realistic approach than using hits

# MANUAL CALIBRATION METHOD

- Single particle calibrations
  - Simulation campaign [26.05.0]
  - Focus on 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  $\sigma/\mu$
    - $A$  is set as  $1/\text{mean}$  of the distribution with optimal  $B$

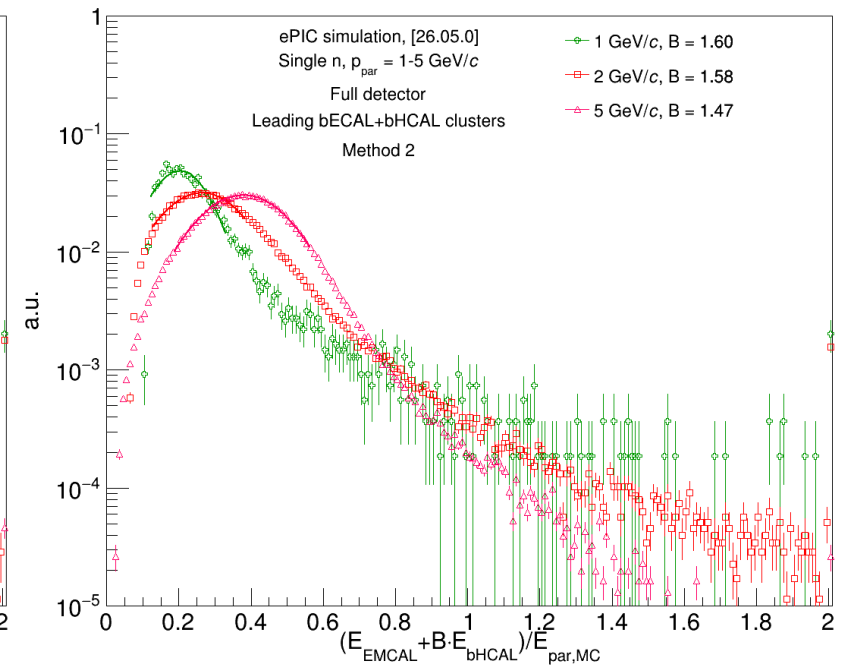
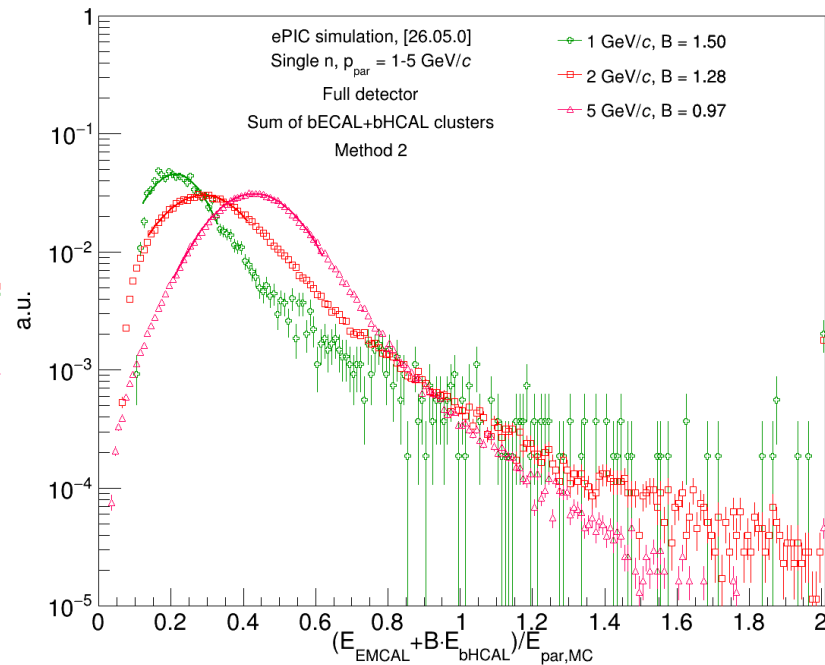
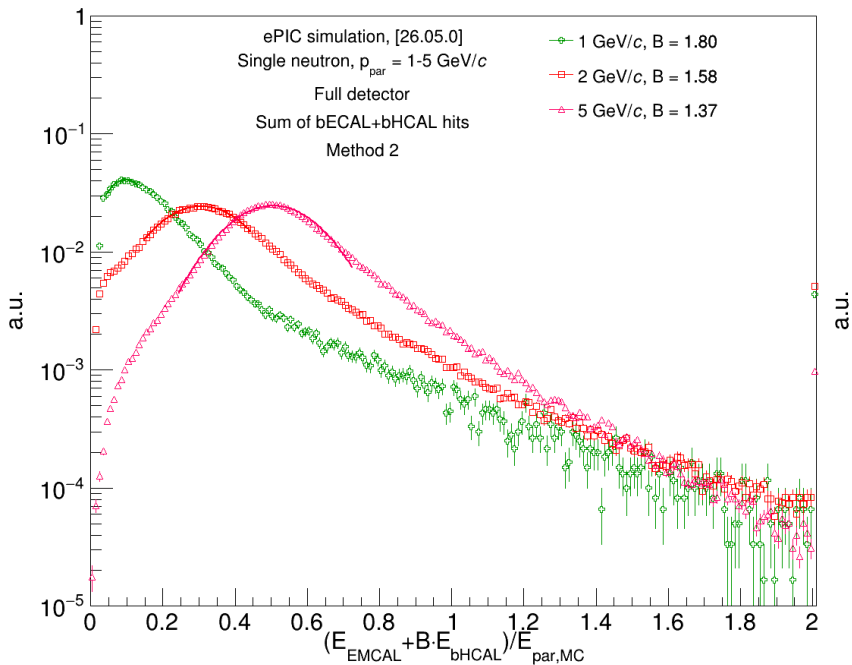
# UNCALIBRATED ENERGY — $n$

- Uncalibrated energy deposition in bECAL+bHCAL for neutrons
  - (left) Sum of all hits
  - (middle) Sum of all clusters
  - (right) Leading clusters



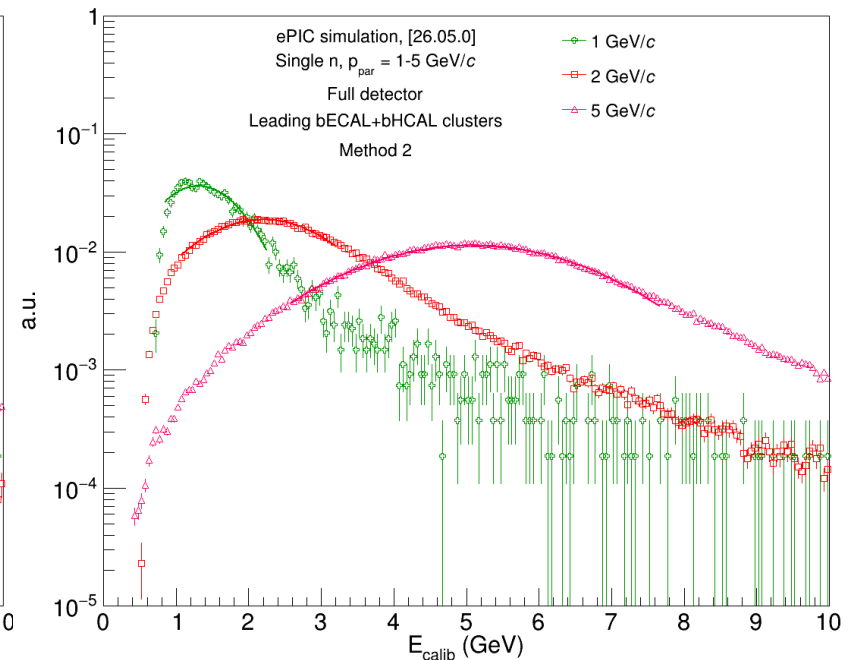
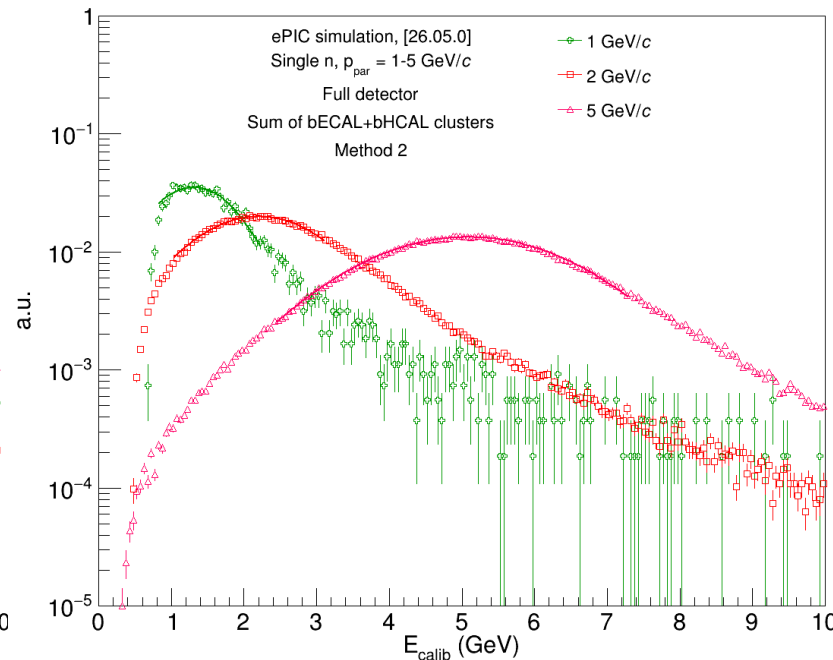
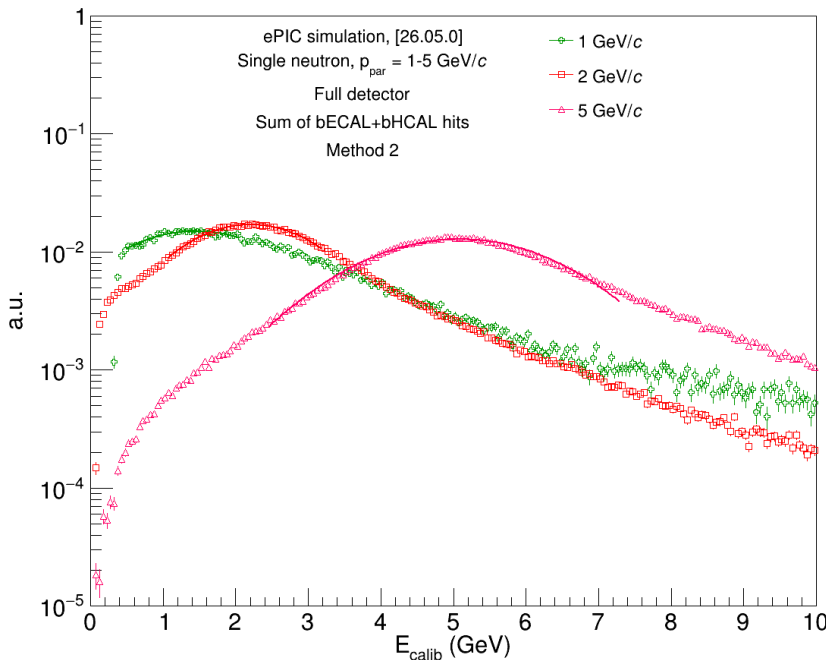
# CALIBRATION DISTRIBUTIONS — $n$

- Calibration distributions for bECAL+bHCAL for neutrons
  - (left) Sum of all hits
  - (middle) Sum of all clusters
  - (right) Leading clusters



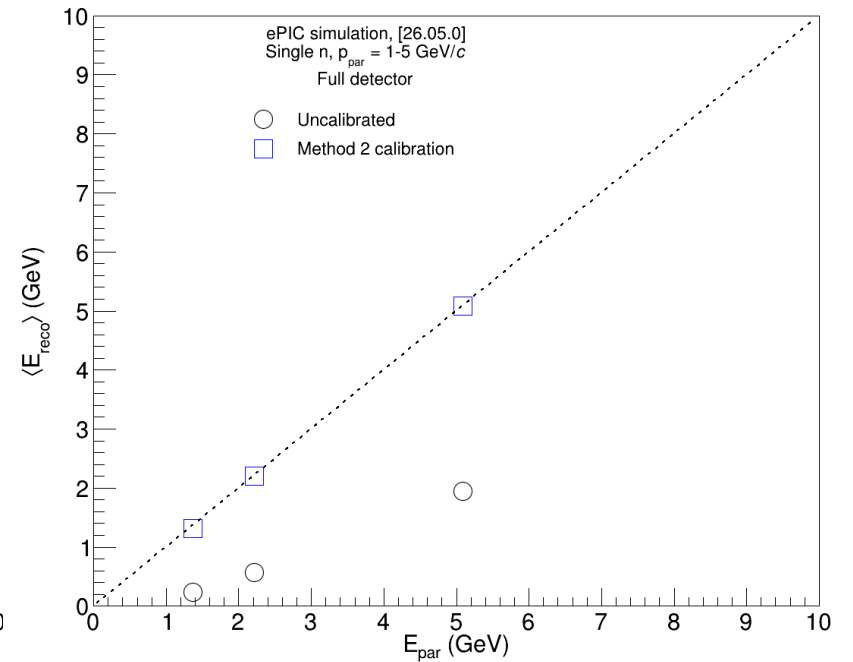
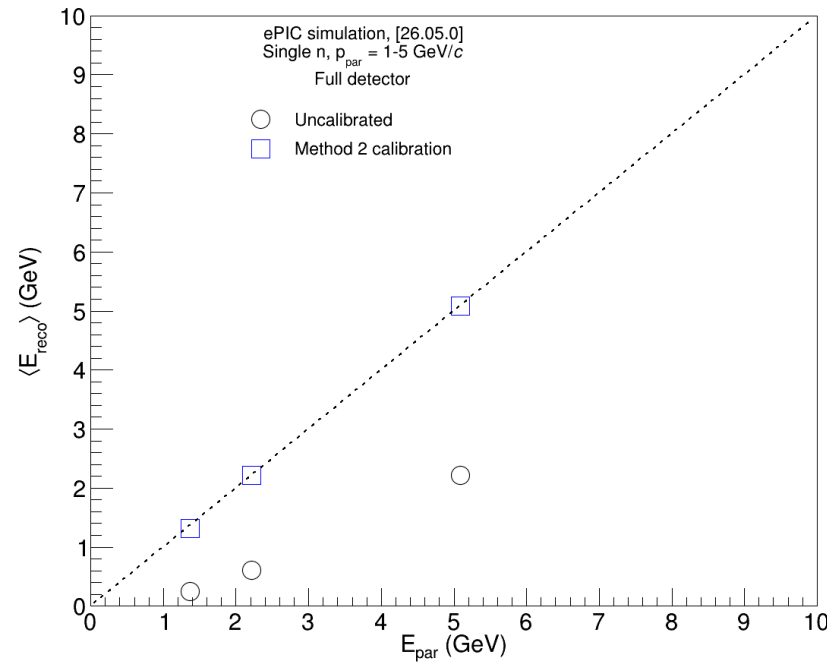
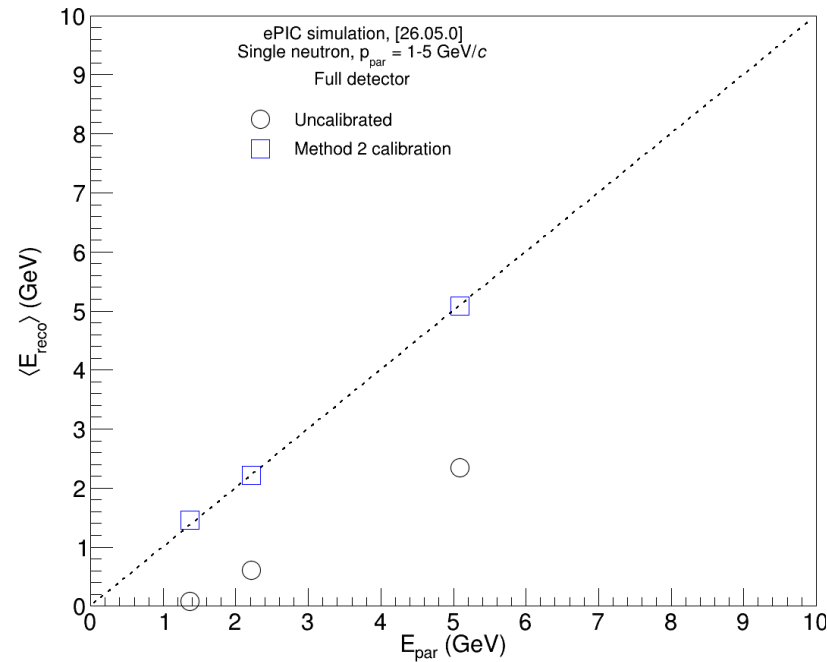
# CALIBRATED ENERGY — $n$

- Calibrated energy deposition in bECAL+bHCAL for neutrons using Method 2 procedure
  - (left) Sum of all hits
  - (middle) Sum of all clusters
  - (right) Leading clusters



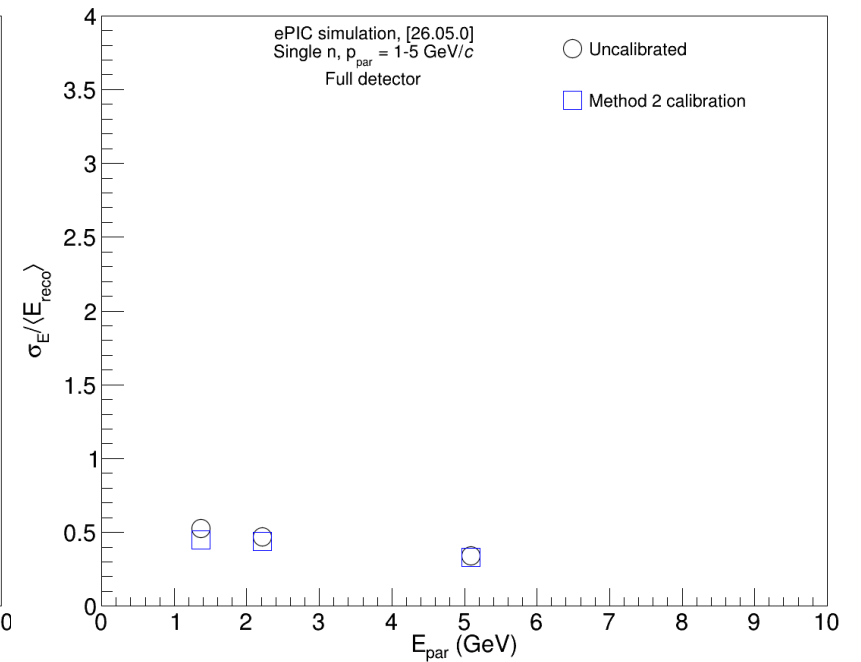
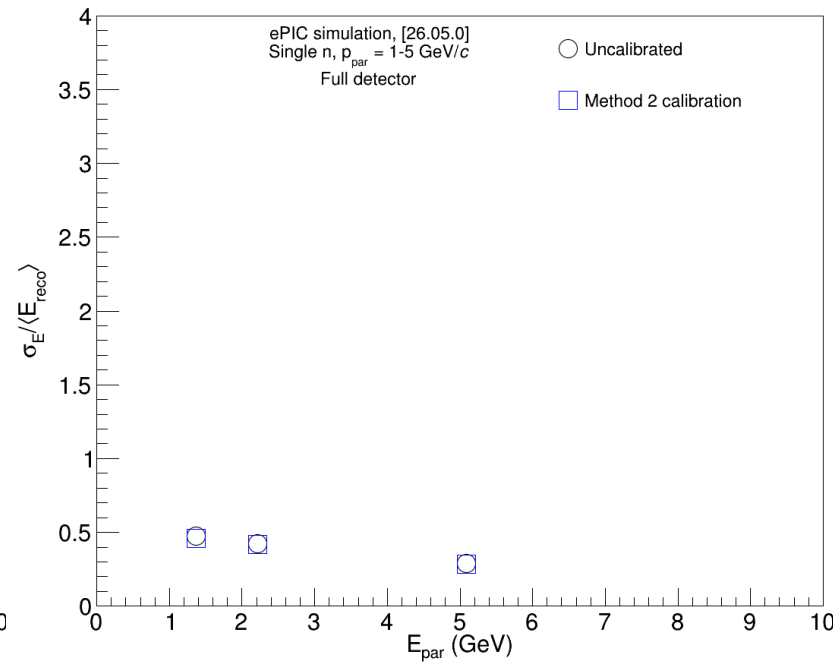
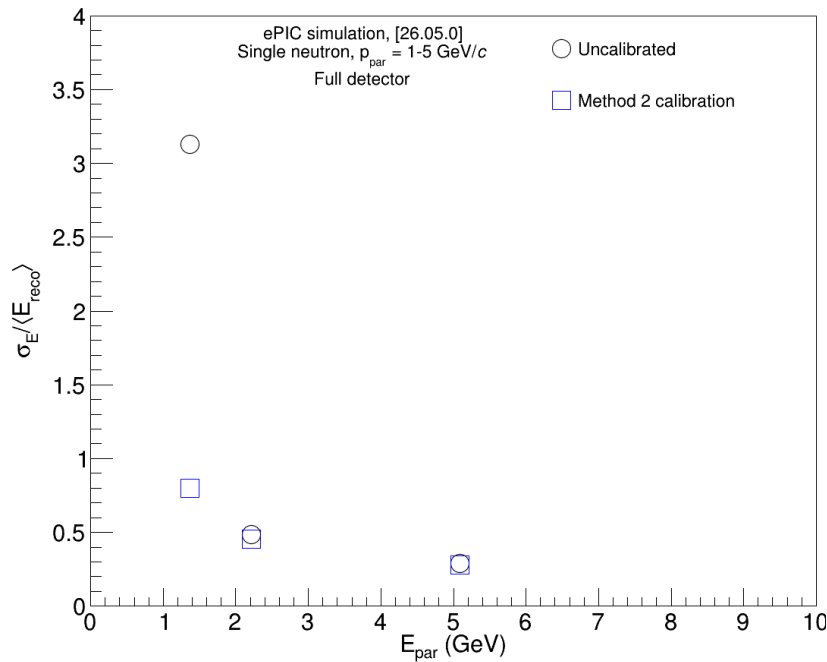
# CALIBRATION RESULT – $n$

- MC  $n$  energy vs. mean RC  $n$  calibrated energy
  - (left) Sum of all hits
  - (middle) Sum of all clusters
  - (right) Leading clusters



# ENERGY RESOLUTION — $n$

- Energy resolution for  $n$ 
  - (left) Sum of all hits
  - (middle) Sum of all clusters
  - (right) Leading clusters



# SUMMARY AND OUTLOOK

- Implemented Method 2 calibration using bECAL and bHCAL clusters
  - Seems to be working well, but with some noticeable differences compared to using hits
  - Will investigate more to understand the differences
- Outlook:
  - Other particle species with clusters
    - In advanced stage, will show next week after a few checks
  - Cluster vs. hit QA
    - Comparison of energy deposition in bECA+bHCAL system from hits and reconstructed clusters

**THANK YOU FOR ATTENTION**