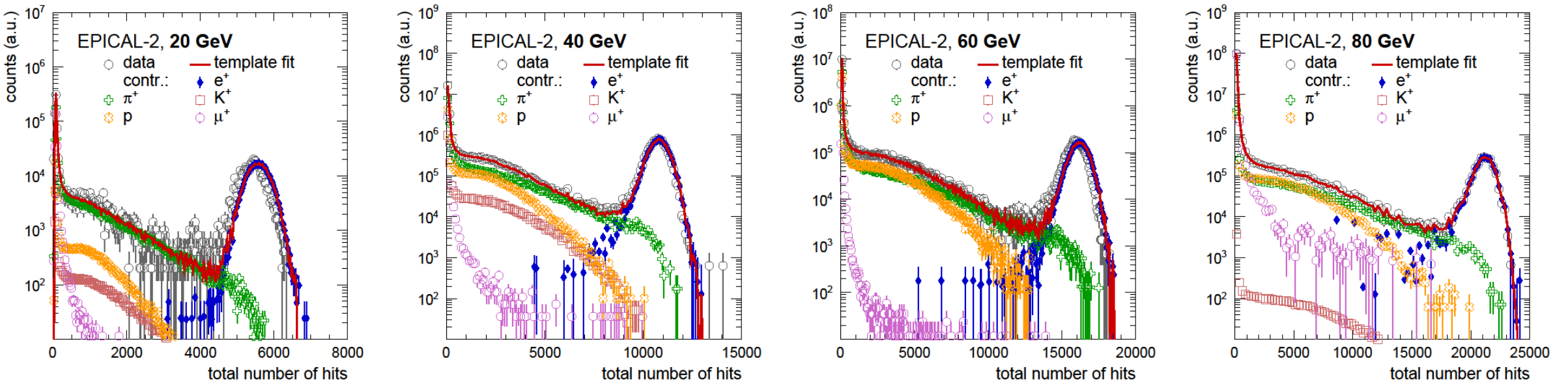


# Renewed Plots for the Paper

Johannes Keul

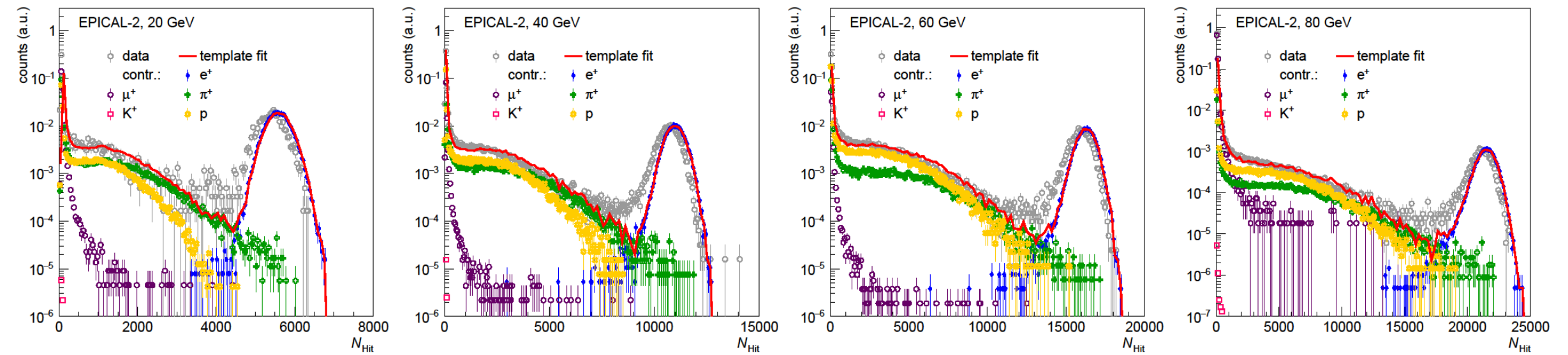


# Old Plots



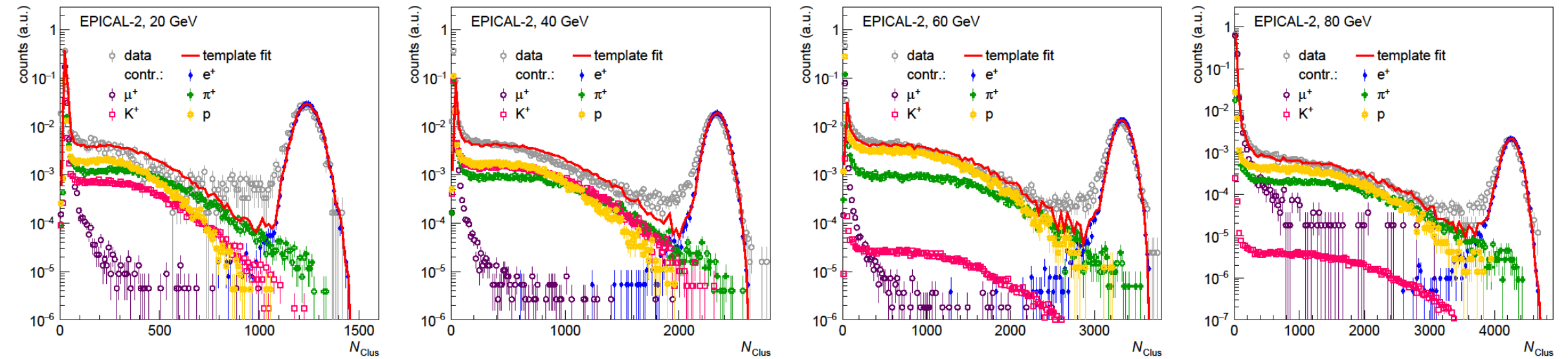
- Plots from section “3.1 SPS beam composition“
- Done by Tim
- Utilize old simulation

# New Plots (Hits)



- Utilize new simulation

# New Plots (Clusters)



- Utilize new simulation
- Template fit works better for clusters since the new simulation describes  $N_{\text{Clus}}$  better than  $N_{\text{Hit}}$

# Which SPS Event Selection Should We Use?

Johannes Keul



# Different Selections

5 sigma:

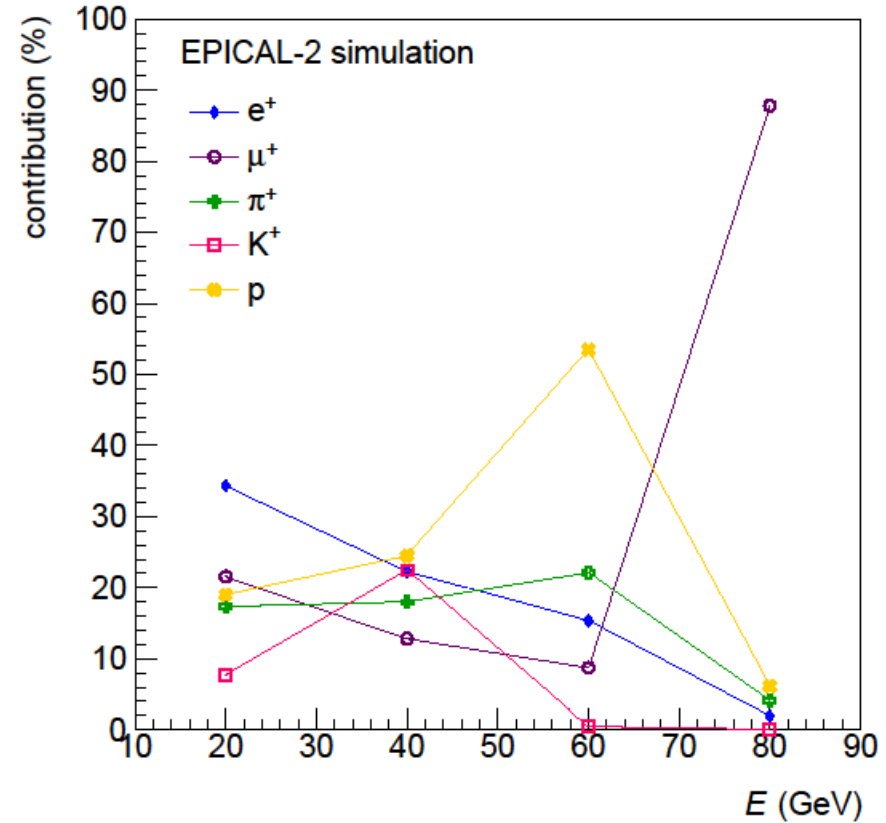
- Selects all events with  
 $\mu - 5\sigma < N_{\text{Hit}} < \mu + 5\sigma$

Advanced selection:

- Applies the 5 sigma selection
- Additionally uses cuts on the following shower shape parameters:
  - Layer of shower start
  - Fraction of hits in the shower core
  - Spread of hits in x-y-direction
  - Forward to total ratio

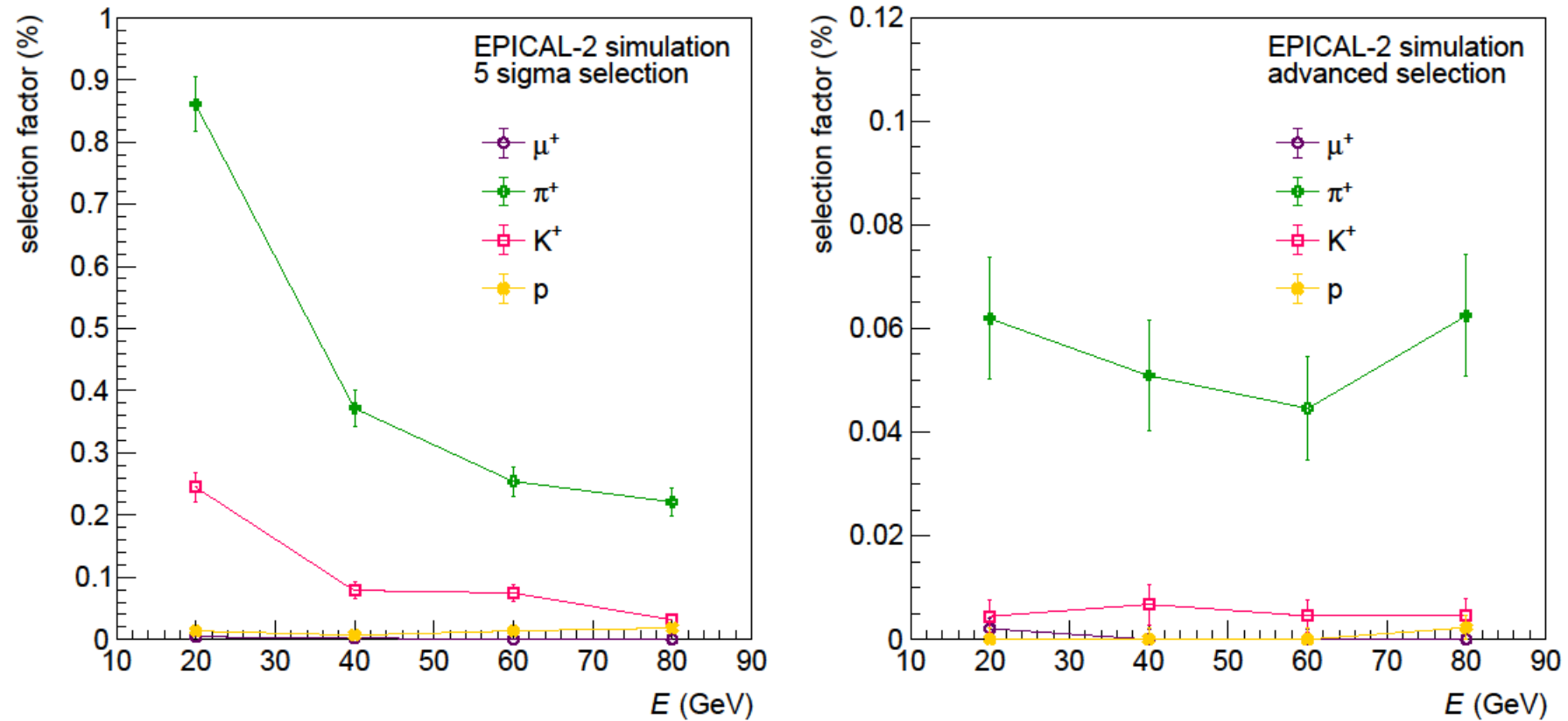
# Beam Composition

- Calculate beam composition from template fit
- Results for the new simulation are similar to what Tim showed in his PhD thesis for the old simulation



# Selection Factors for Hadrons and Muons

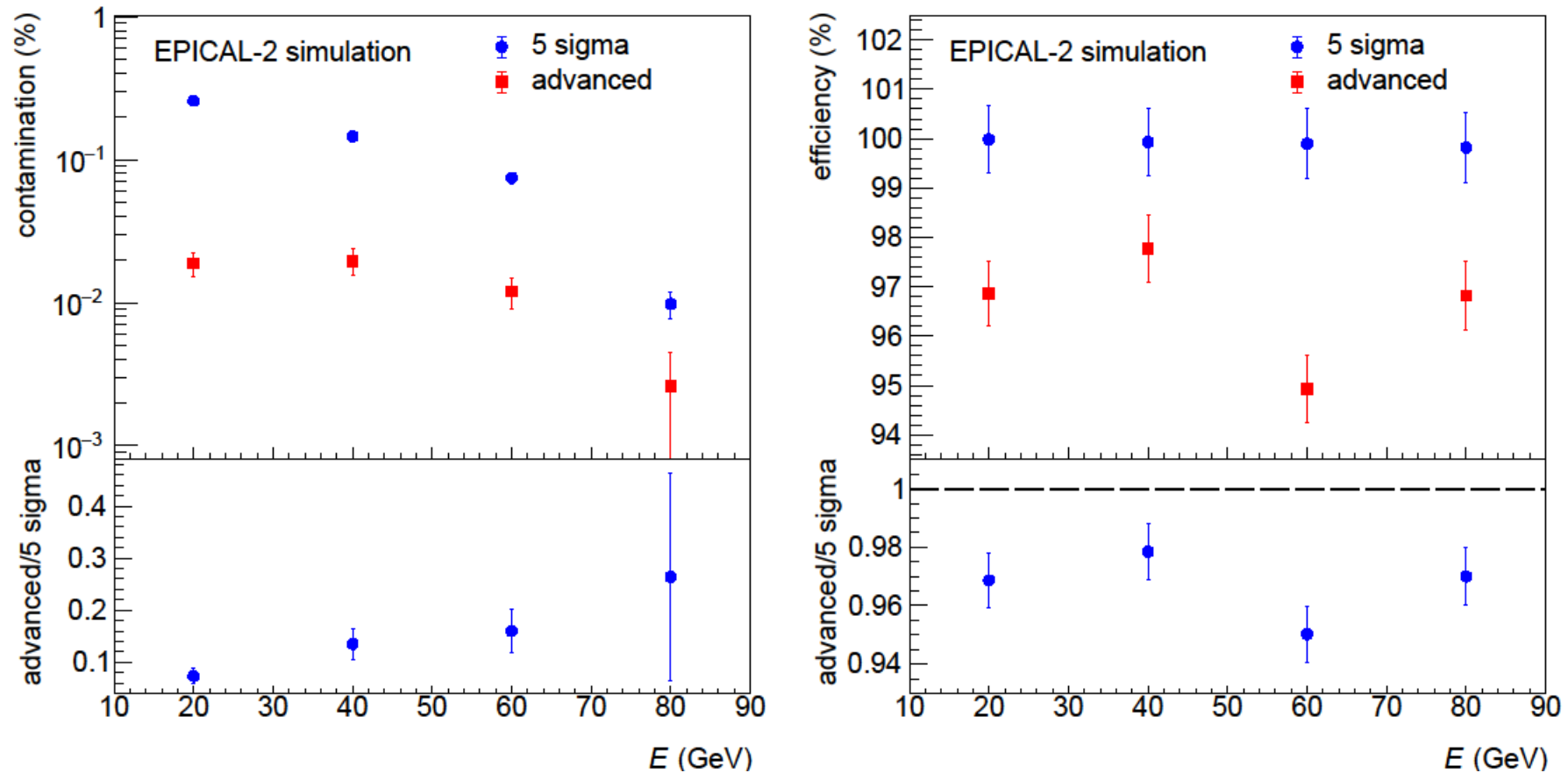
- Which fraction of hadrons and muons gets falsely selected?



- Advanced selection selects approximately 10x fewer hadrons
- With both selections, pions are the hadrons that get selected the most frequently
- Muons are irrelevant with both selections

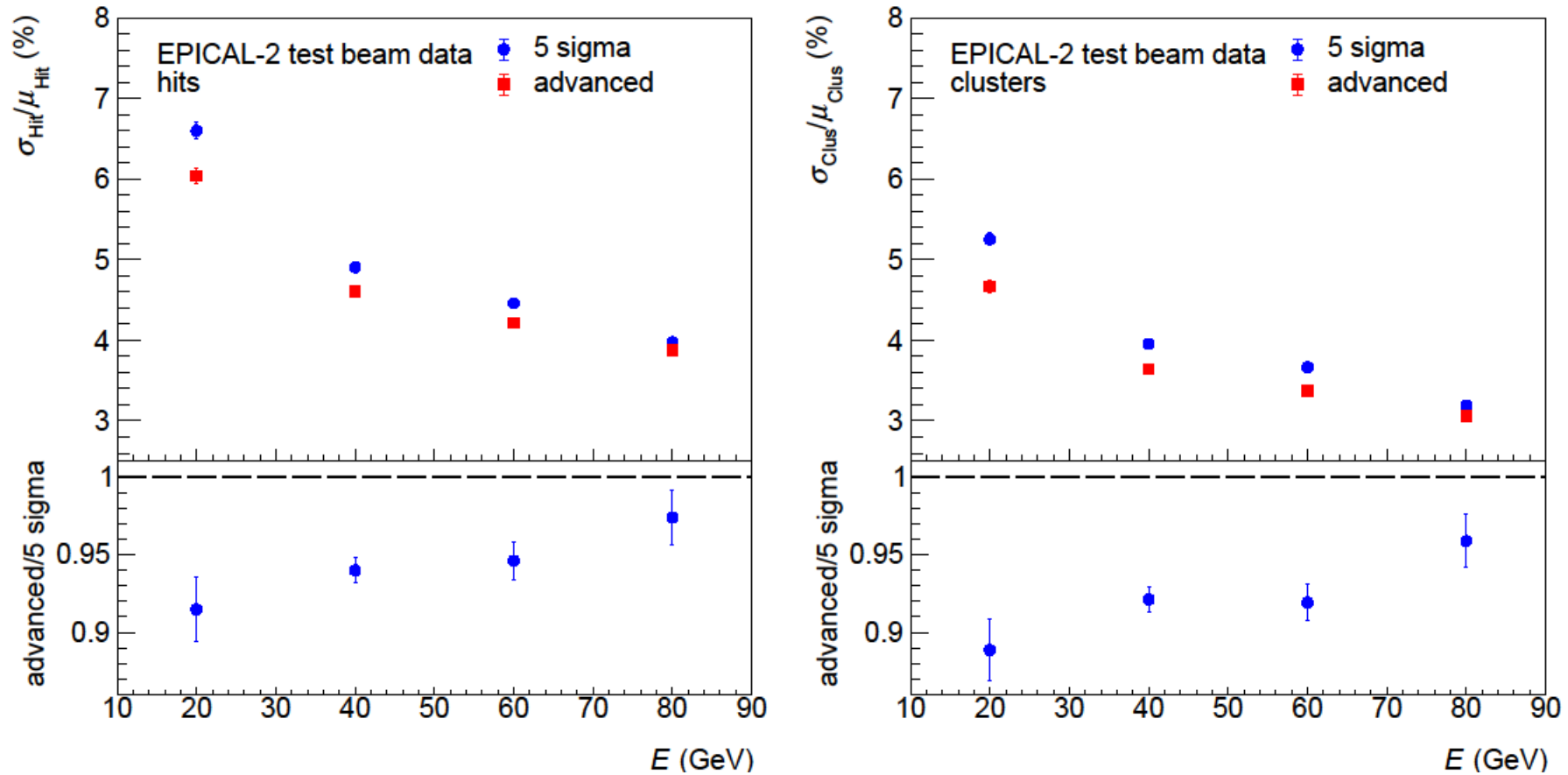


# Contamination and Efficiency



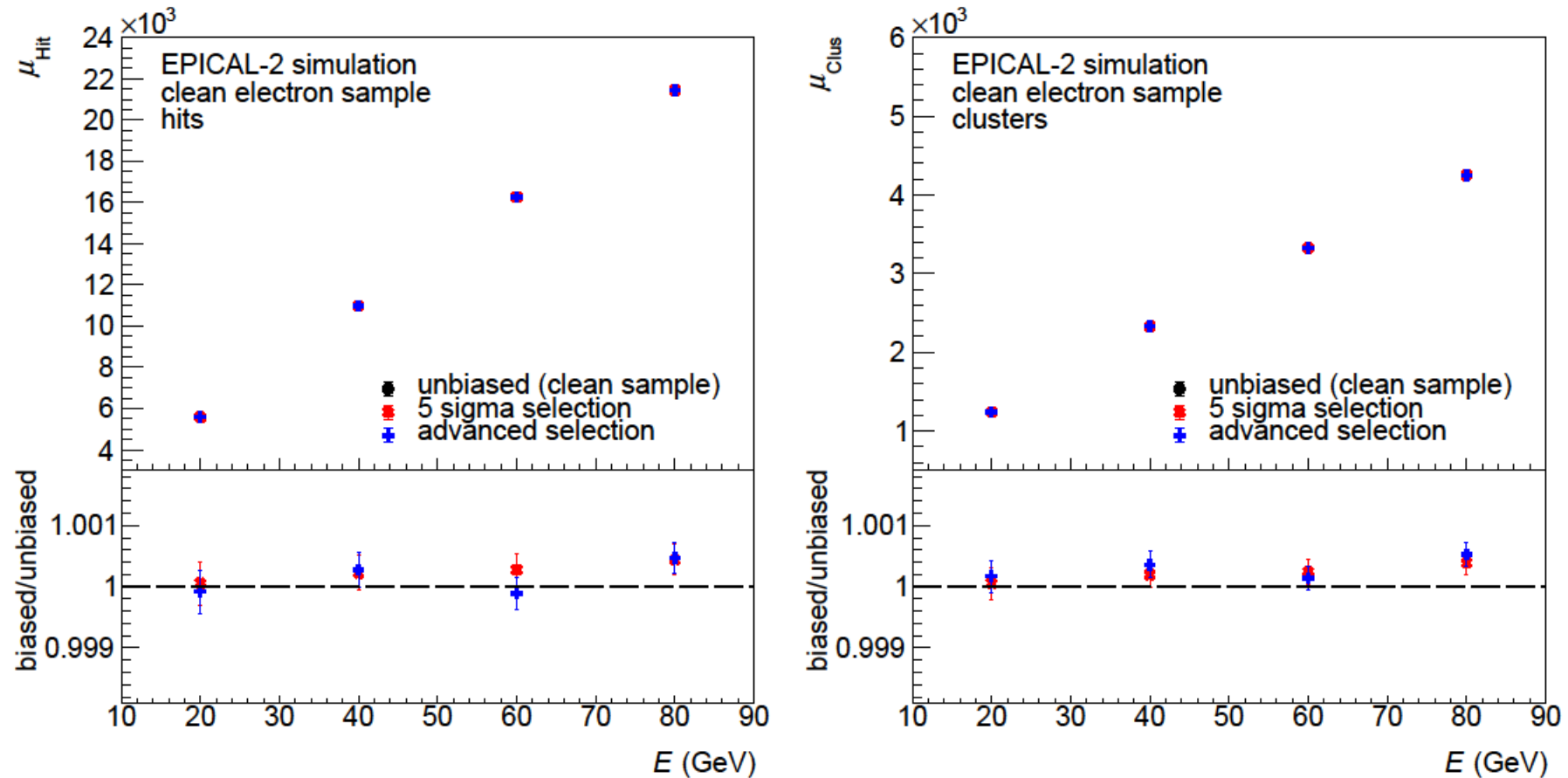
- Advanced selection selects a 3-10 times purer electron sample
- Difference in contamination decreases with energy
- 5 sigma selection has close to 100% efficiency
- Advanced selection loses approximately 4% efficiency

# Resolution



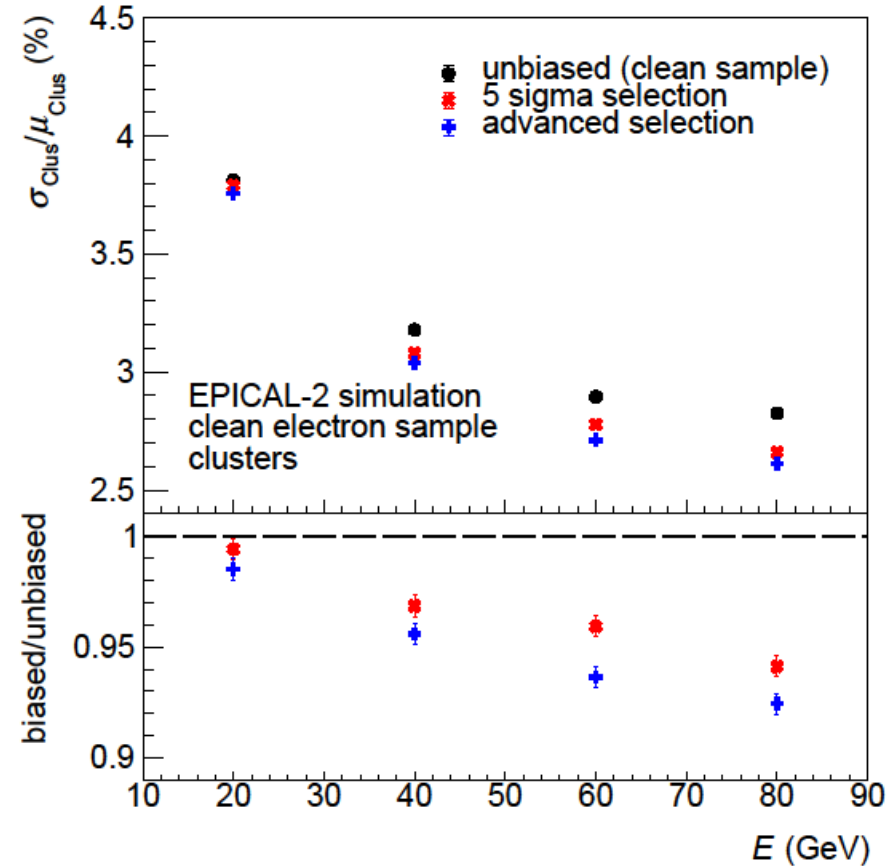
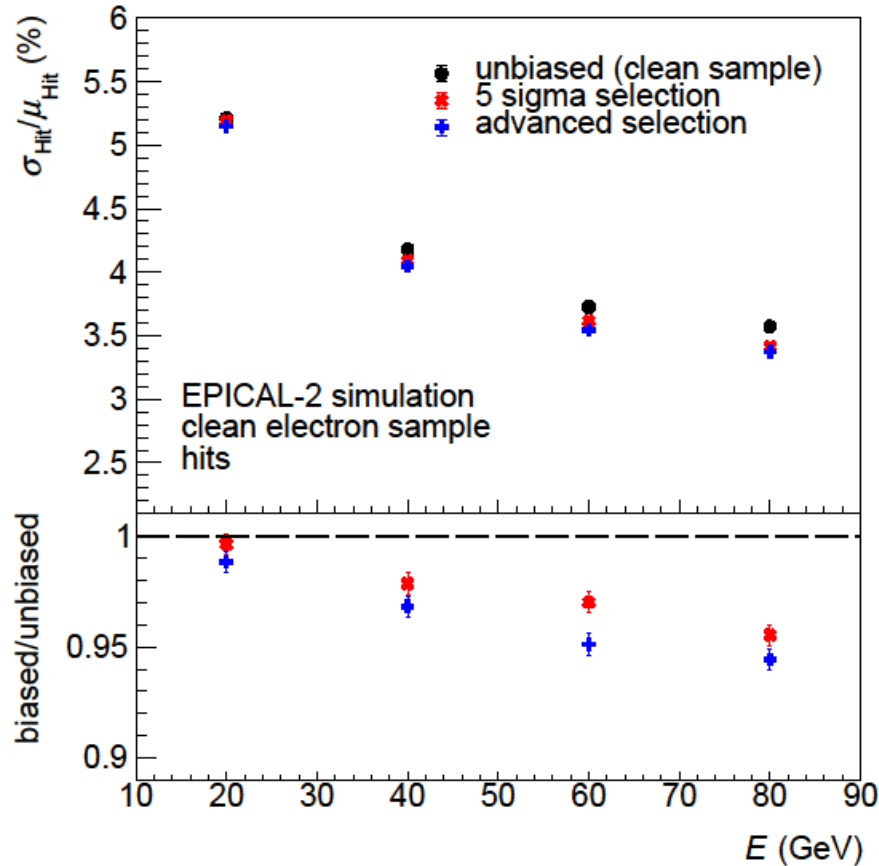
- Advanced selection produces up to 10% better resolution
- Difference in resolution between both selection decreases with energy

# Selection Bias: Response



- Using clean electron sample from simulation to estimate selection bias
- Almost no bias on detector response  $\mu$

# Selection Bias: Resolution



- Using clean electron sample from simulation to estimate selection bias
- Up to 6% better (biased) resolution for  $5\sigma$  selection
- Up to 8% better (biased) resolution for advanced selection

# Comparing the Selections

5 sigma:

- + Larger efficiency
- + Smaller selection bias
- More contamination

Advanced selection:

- + Less contamination
- Lower efficiency
- Larger selection bias