

INTT cluster distributions in Au+Au Run2023

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- While working on $dN_{ch}/d\eta$ analysis, various checks on the reconstructed cluster in Run2023 Au+Au data and simulation show interesting yet puzzling results
- Data and simulation samples used for the comparison
 - Data: Run 20869, DST produced with hot/dead/bad channel maps, BCO difference mask, and the survey geometry
 - Location: `/sphenix/user/hjheng/sPHENIXRepo/analysis/dNdEta_Run2023/production/ProdDST-HotDead-BCO-ADC-Survey/Data_CombinedNtuple_Run20869_HotDead_BCO_ADC_Survey.root`
 - Simulation: HIJING, software build ana.419, DST produced with bad channel maps, ADC conversion map, and the survey geometry
 - Location: `/sphenix/tg/tg01/bulk/dNdeta_INTT_run2023/data/simulation/ana.419/HIJING/fullSim/magOff/detectorMisaligned/dstSet_00001/dNdeta-sim-HIJING-000-00*.root`

Updated vertex position in simulation

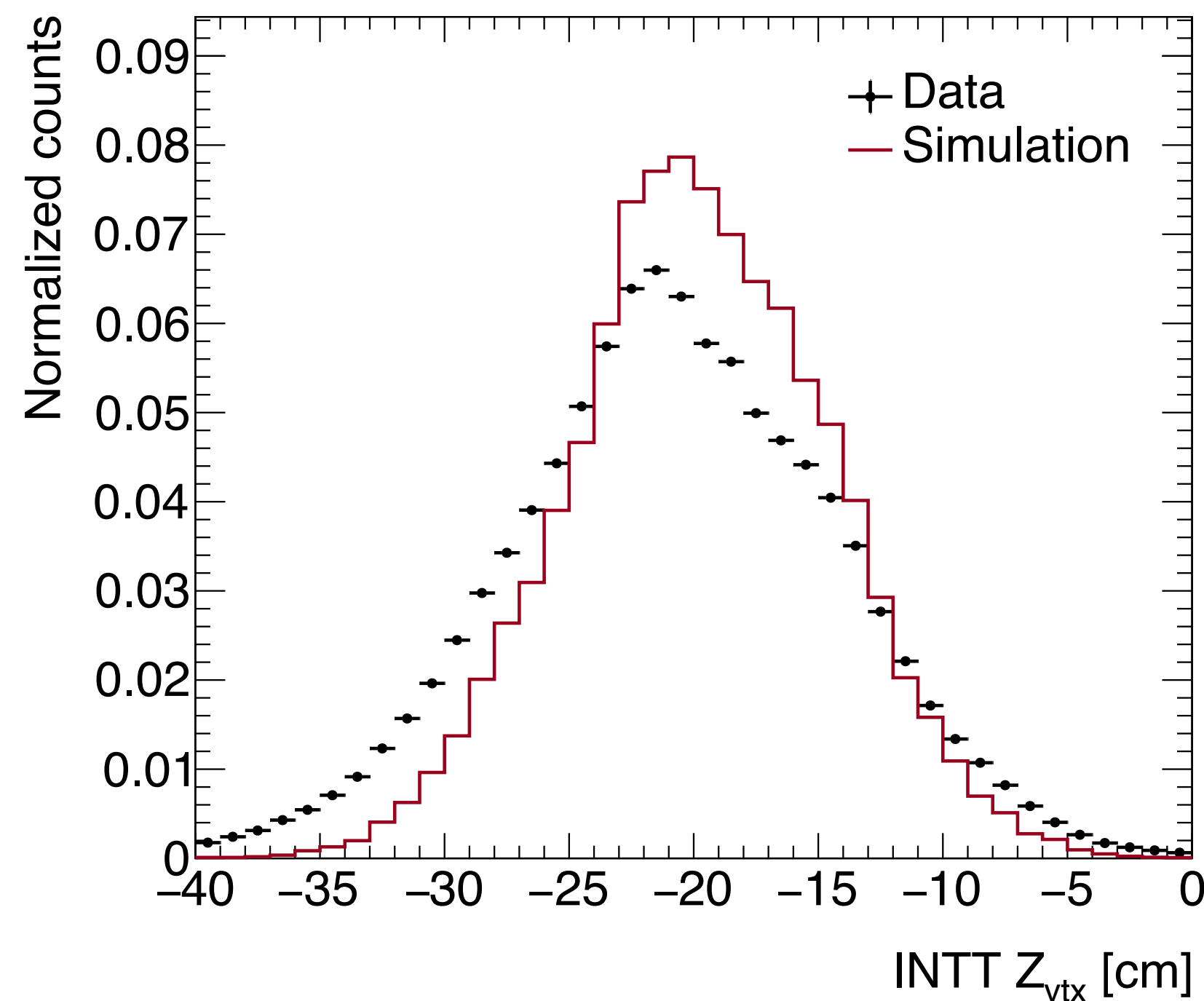


■ Simulation (HIJING) with updated vertex Z position

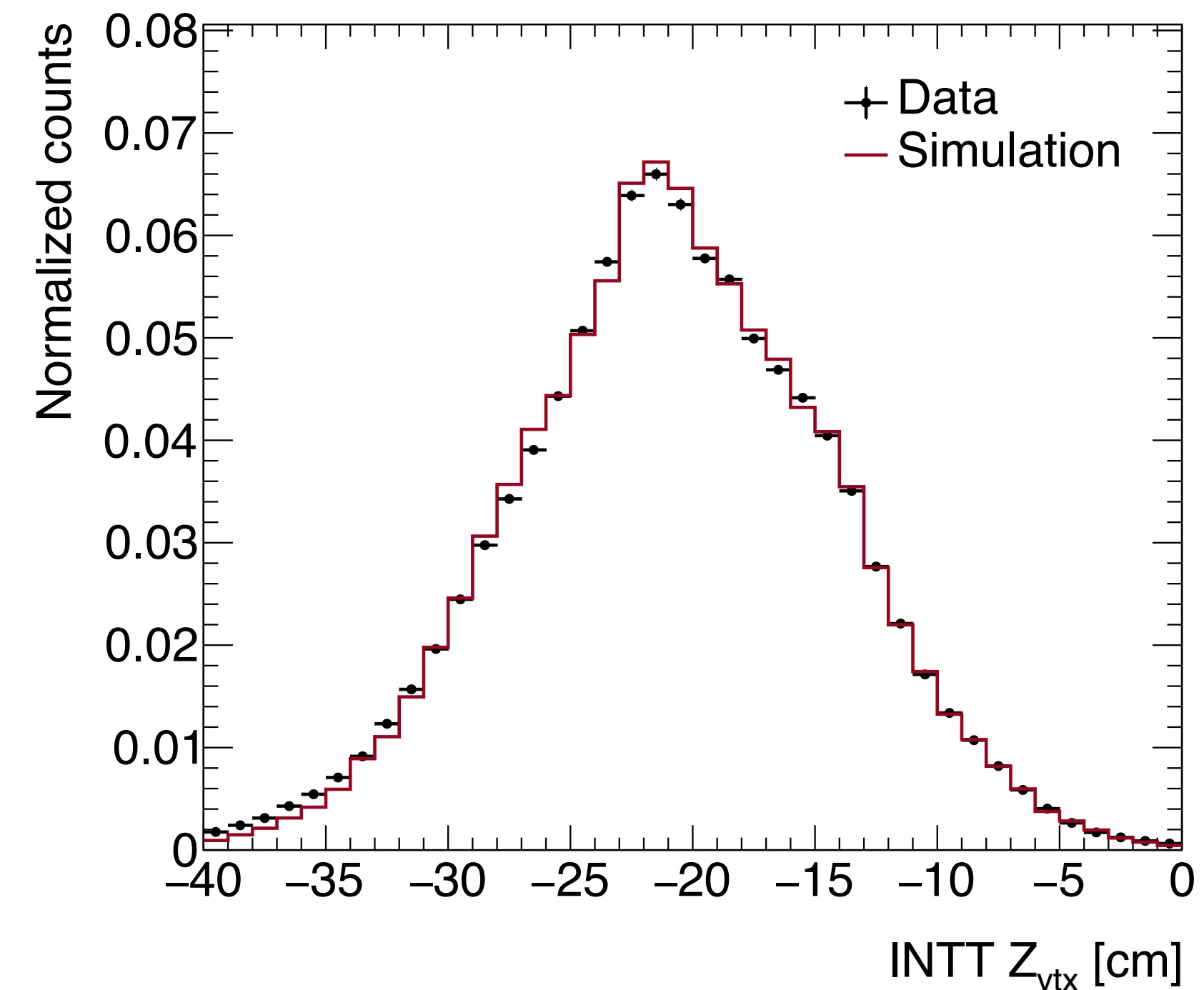
□ **Old:** initial measurement from last year; mean -19.8 cm, width 5.20 cm

□ **New/Current simulation:** updated measurement; mean -20.7 cm, width 6.49 cm

Old

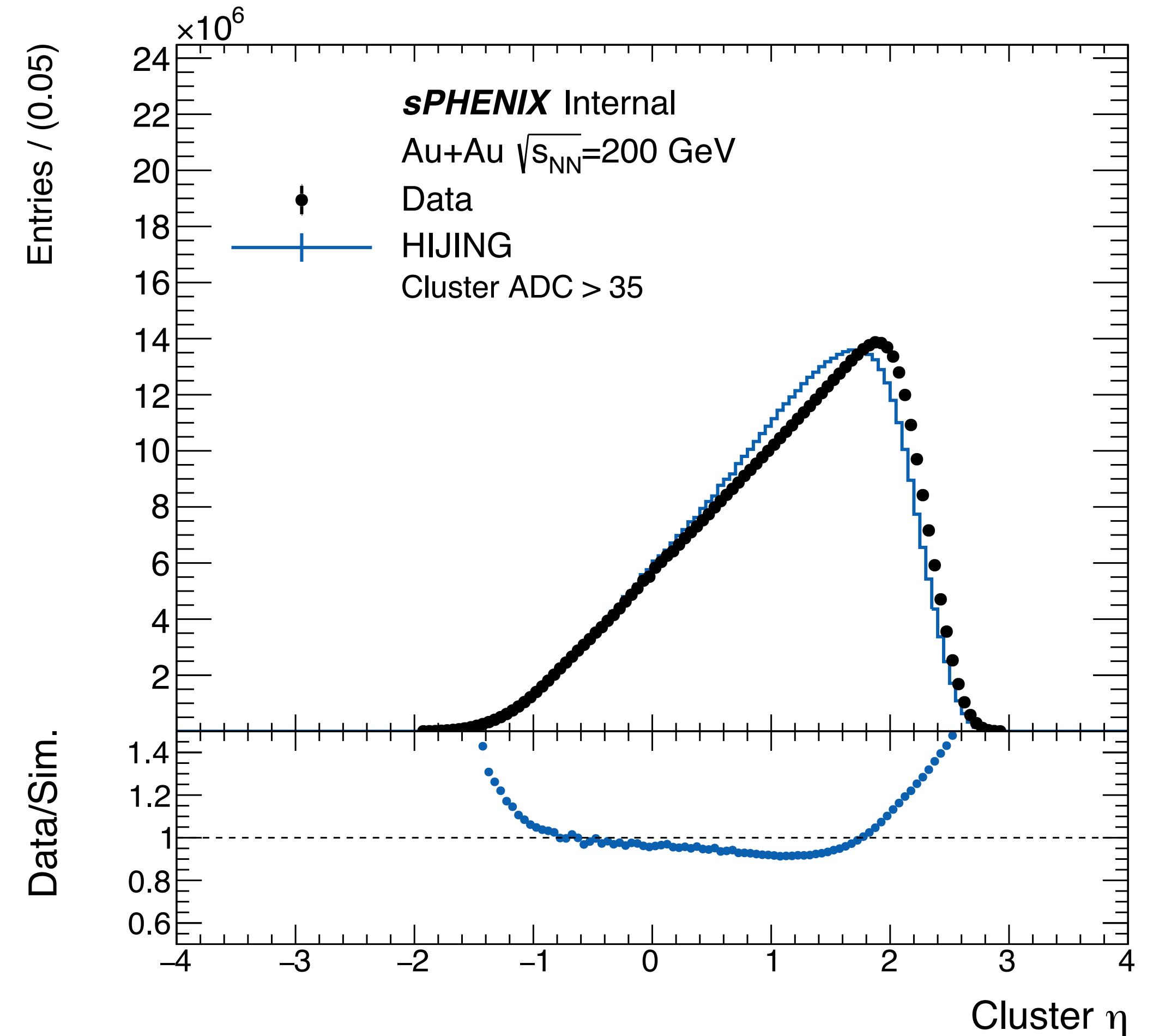
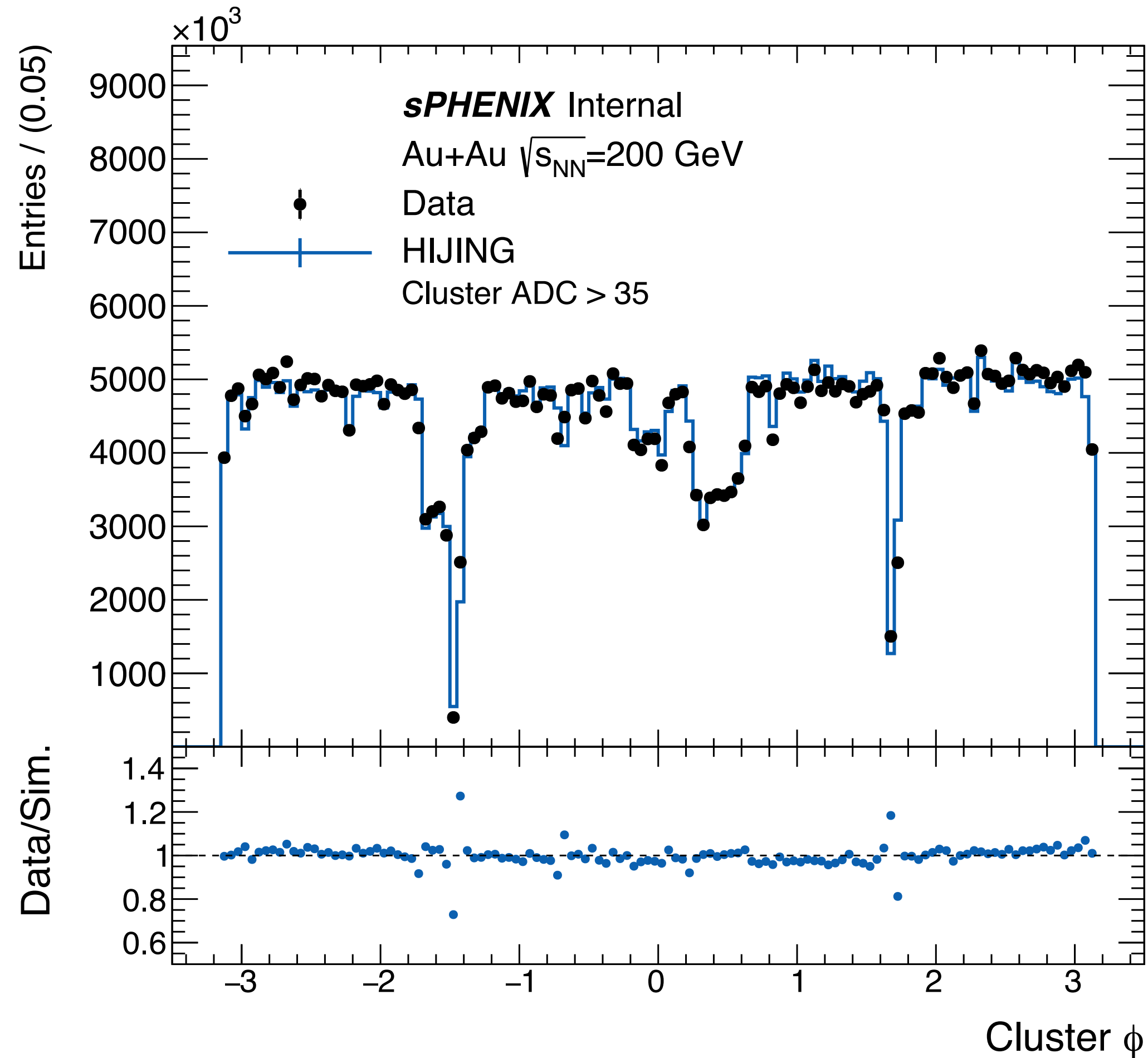


New/Current

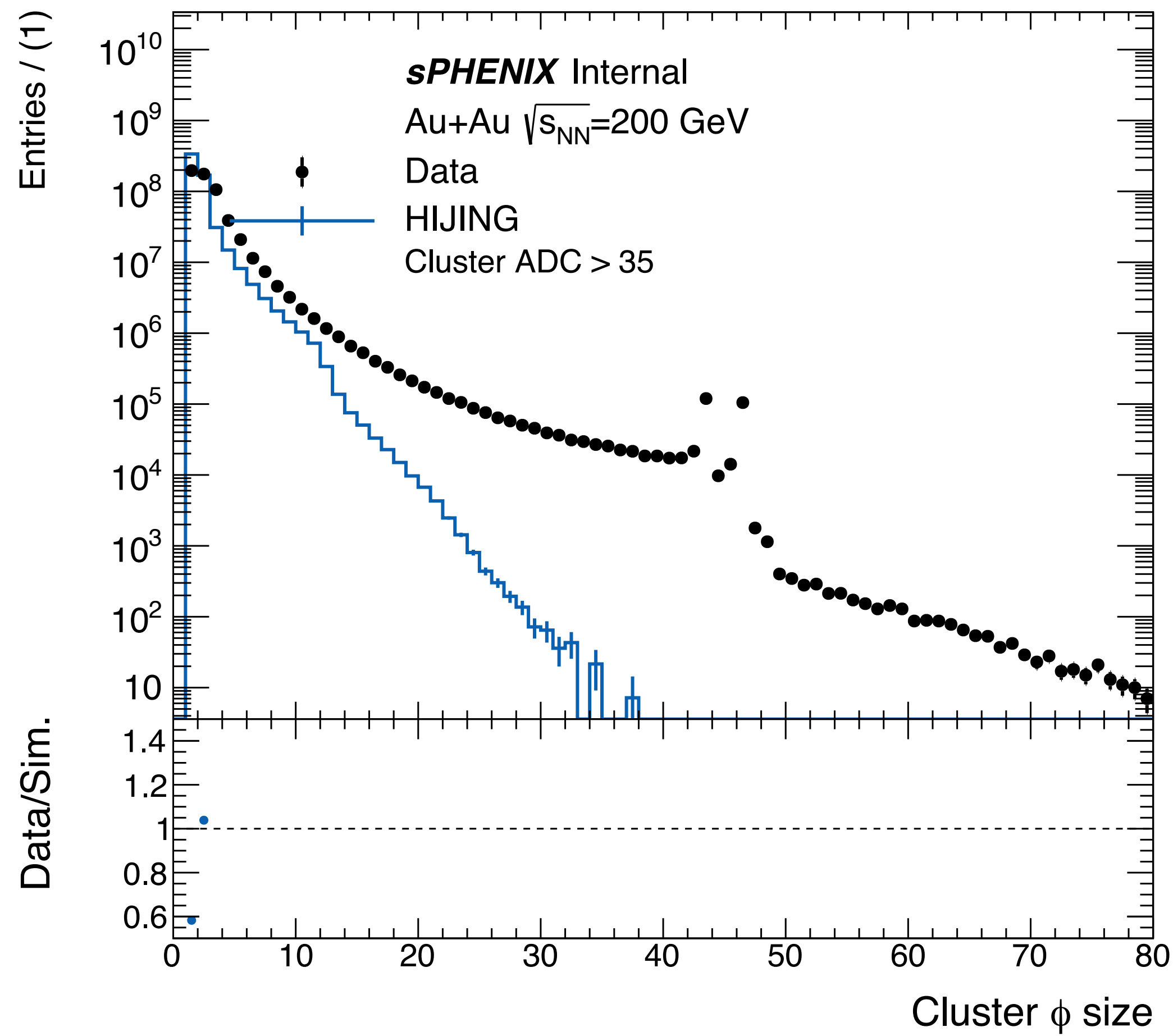
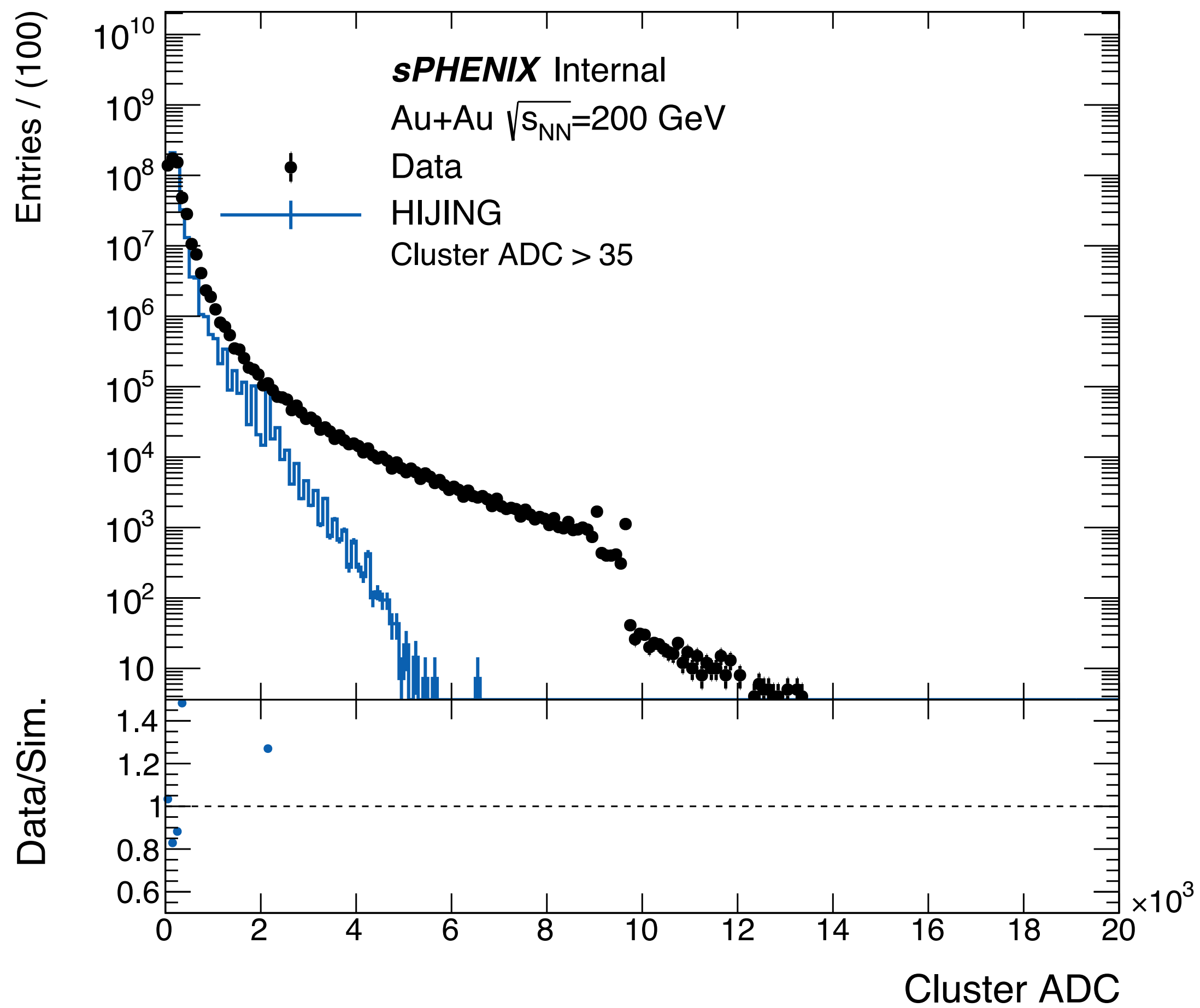


Cluster distributions - ϕ and η

- ϕ and η are calculated with respect to the event vertex



Cluster distributions - ADC & ϕ size

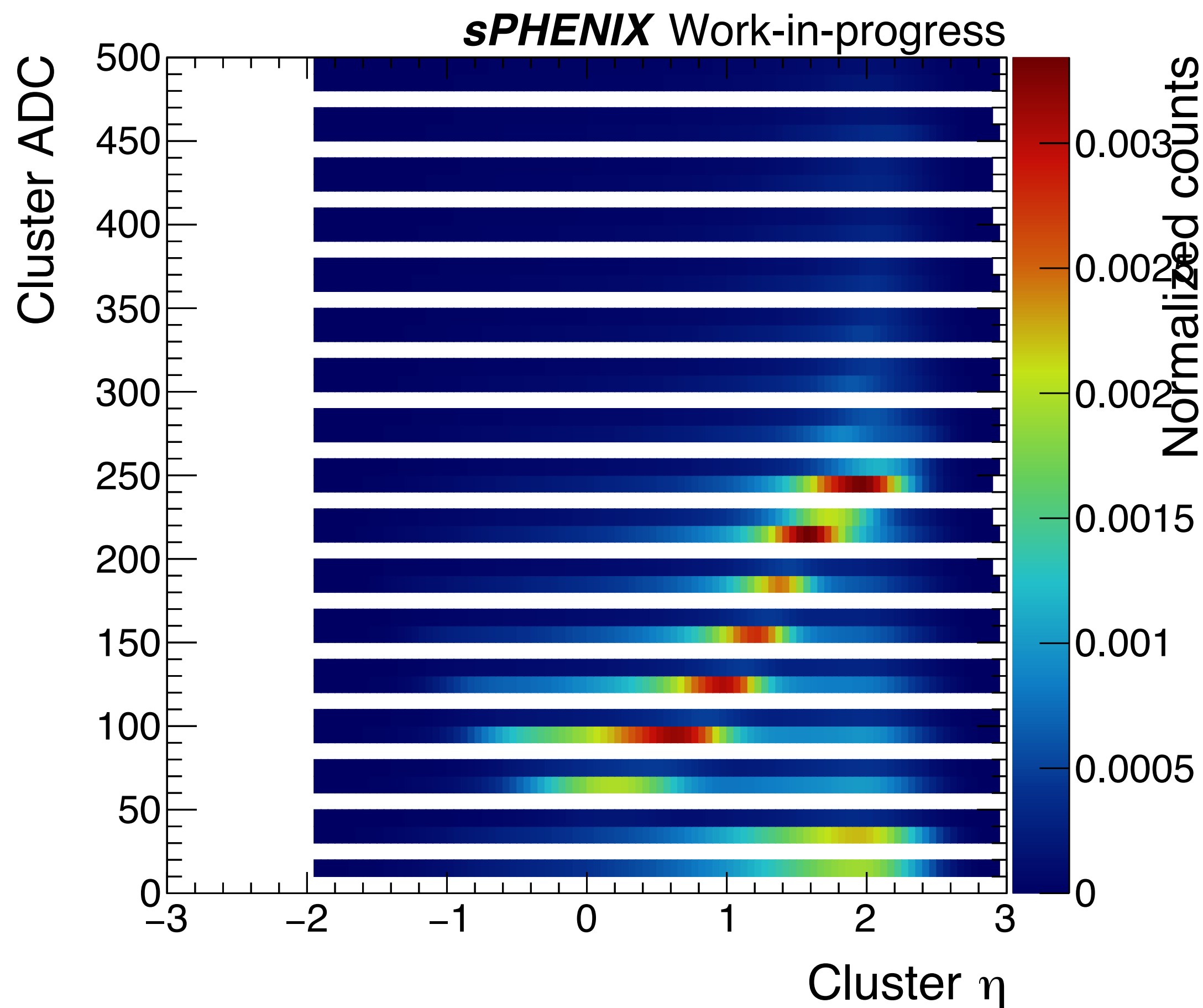


Strong correlation between the cluster ADC and ϕ -size

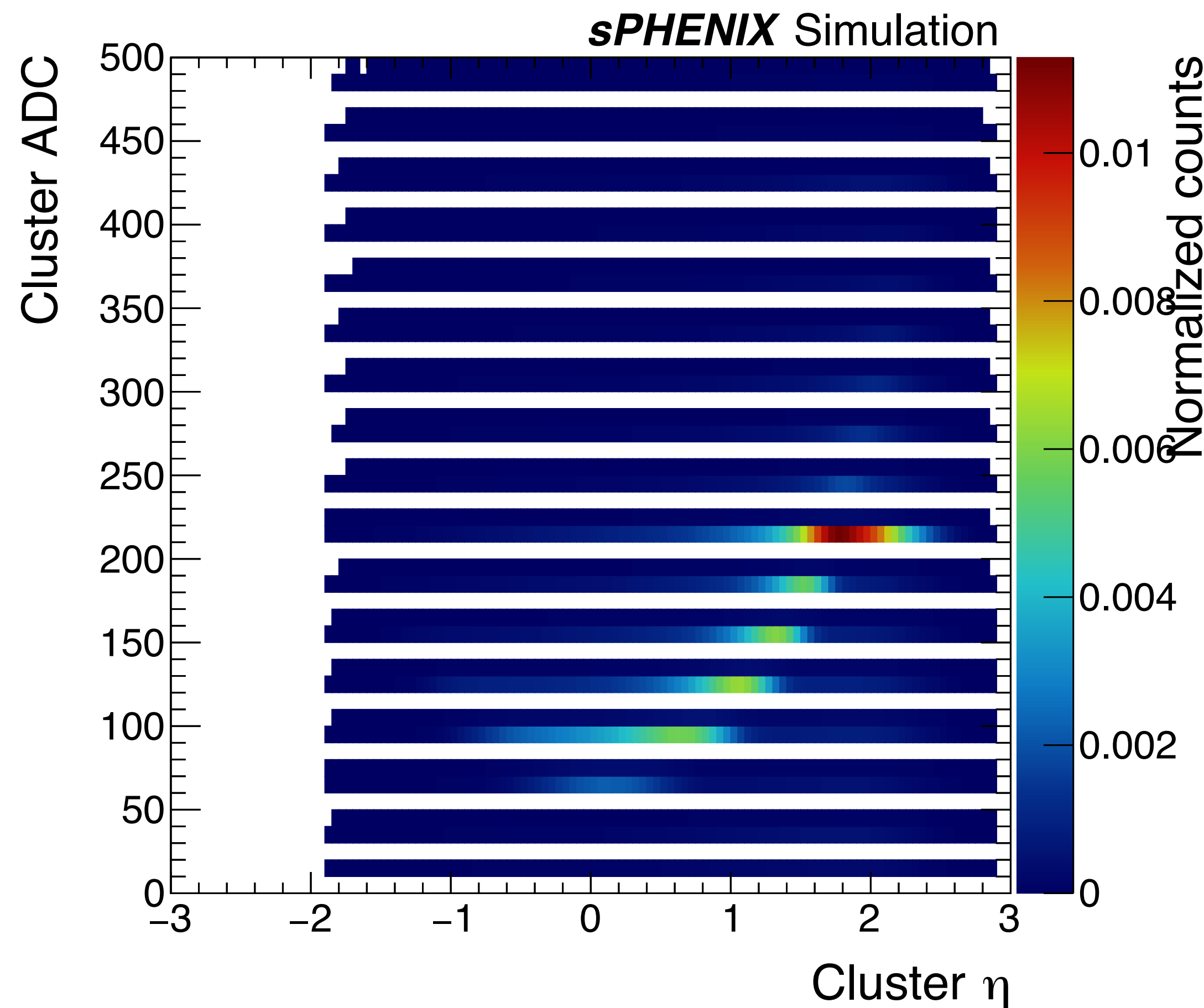
Cluster η v.s Cluster ADC

■ Without cluster ADC > 35 cut (to highlight where the clusters with ADC < 35 are)

Data



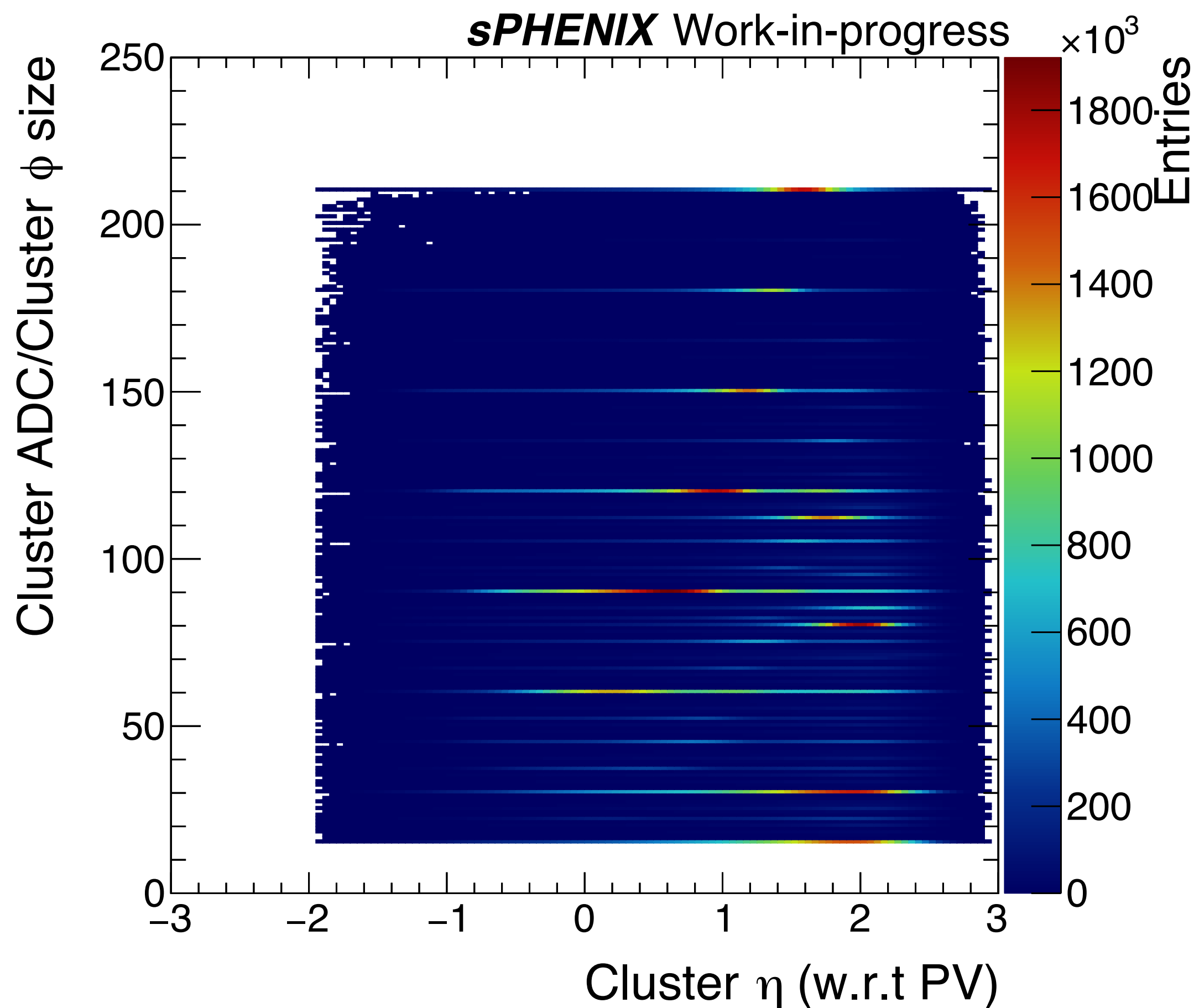
Simulation



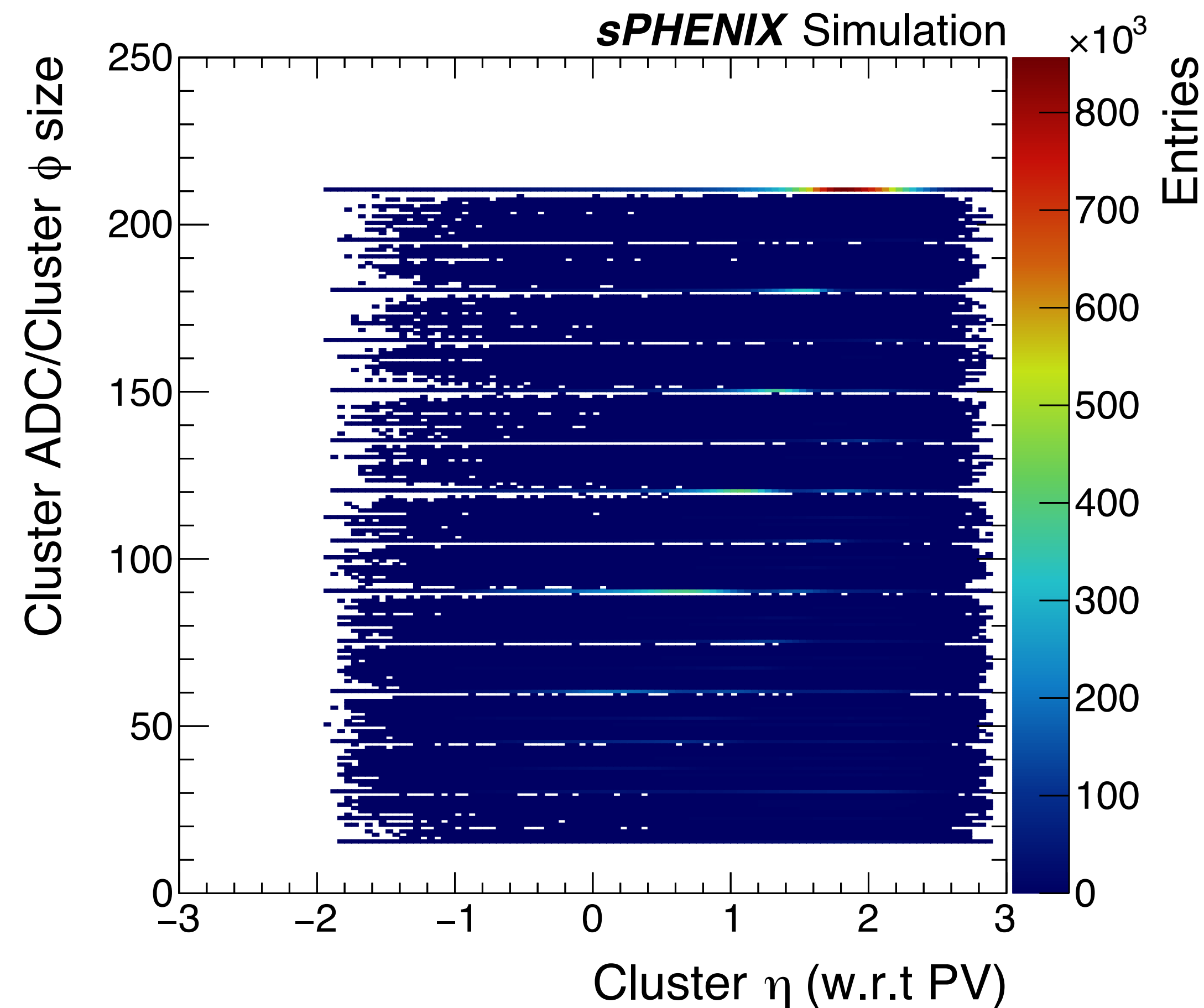
Cluster η v.s Cluster ADC/ ϕ size

■ **Without** cluster ADC > 35 cut (to stress where the clusters with ADC < 35 are)

Data



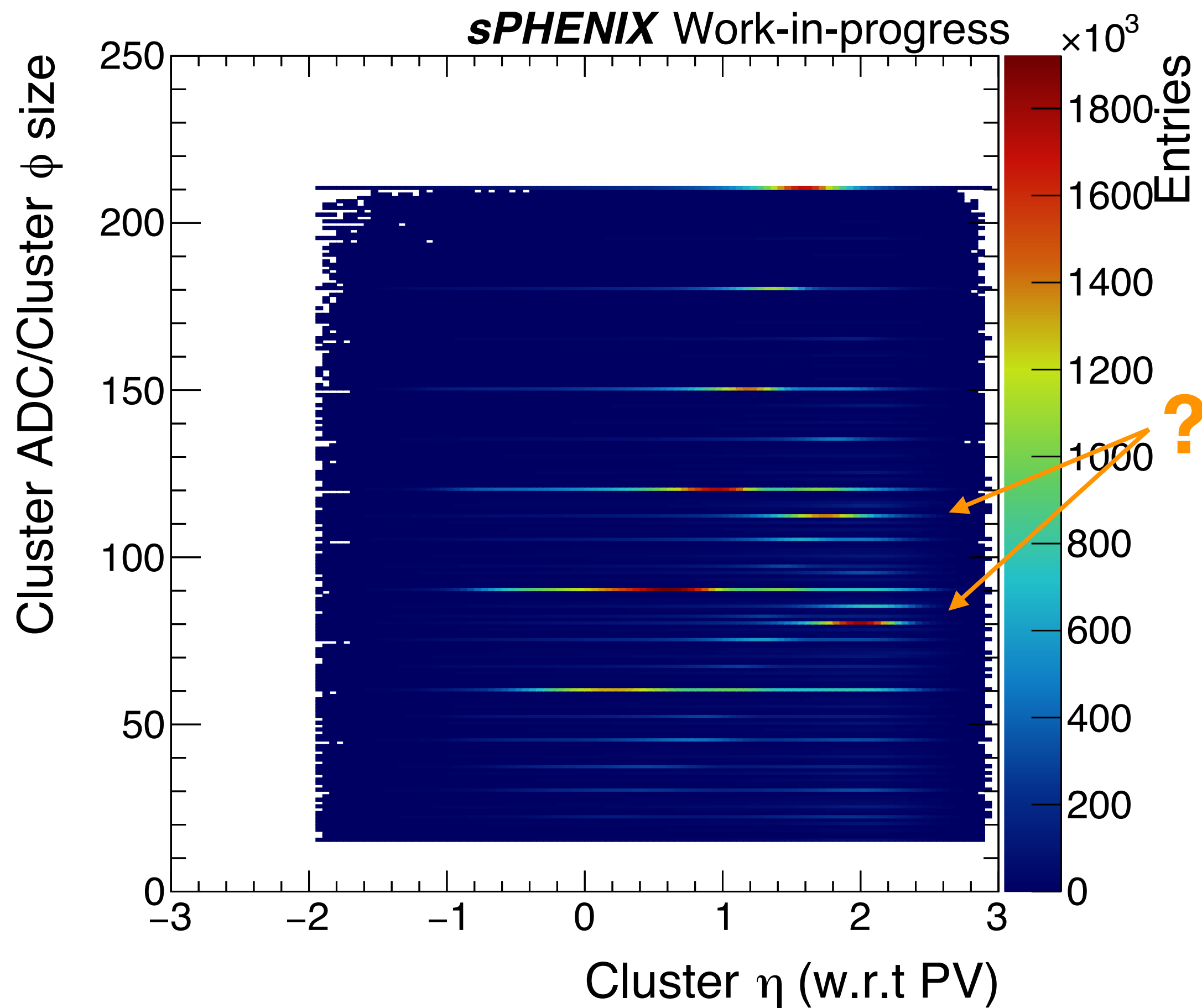
Simulation



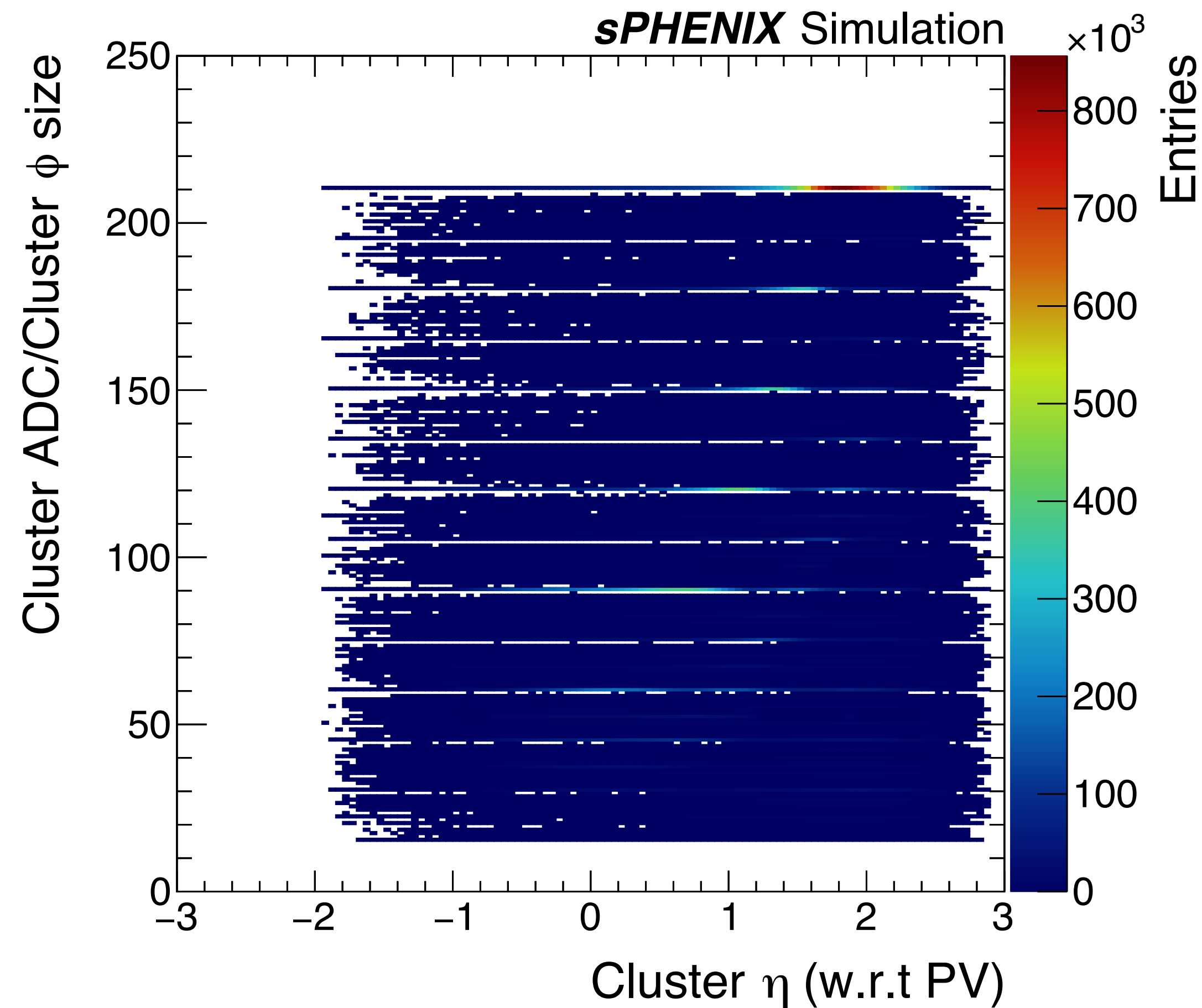
Cluster η v.s Cluster ADC/ ϕ size

■ **With** cluster ADC > 35 cut

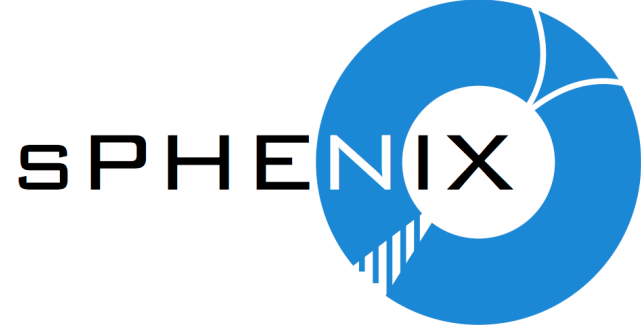
Data



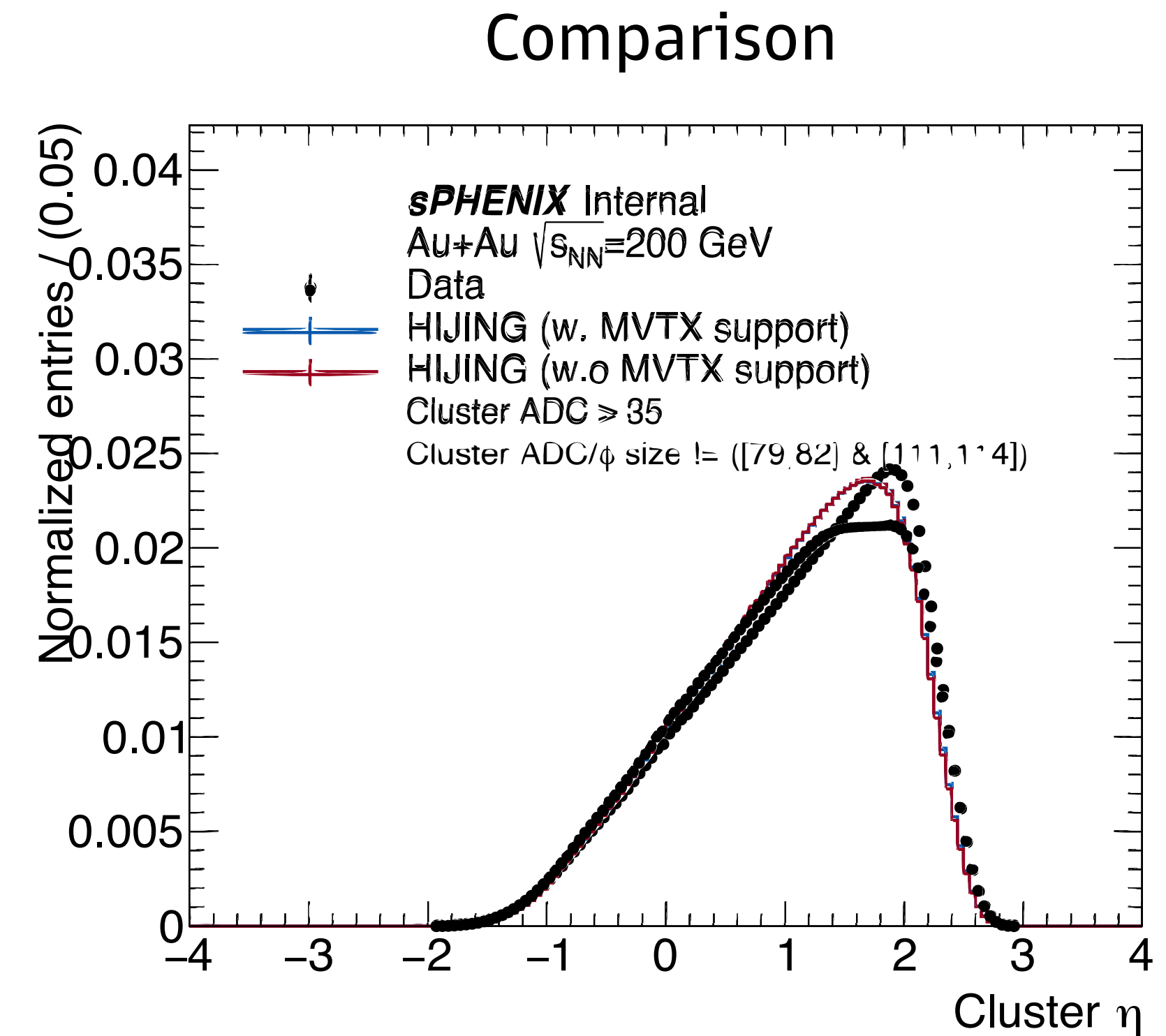
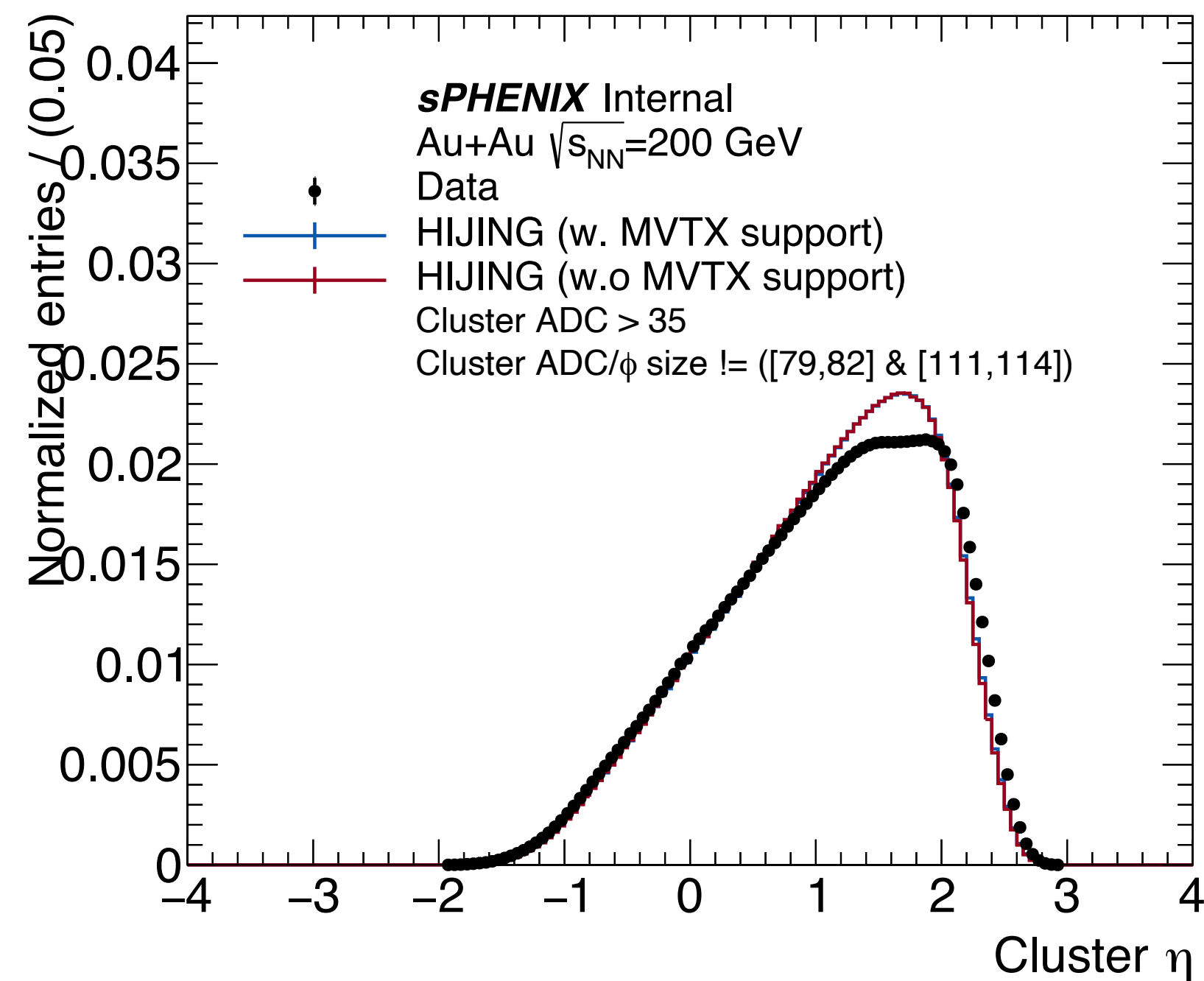
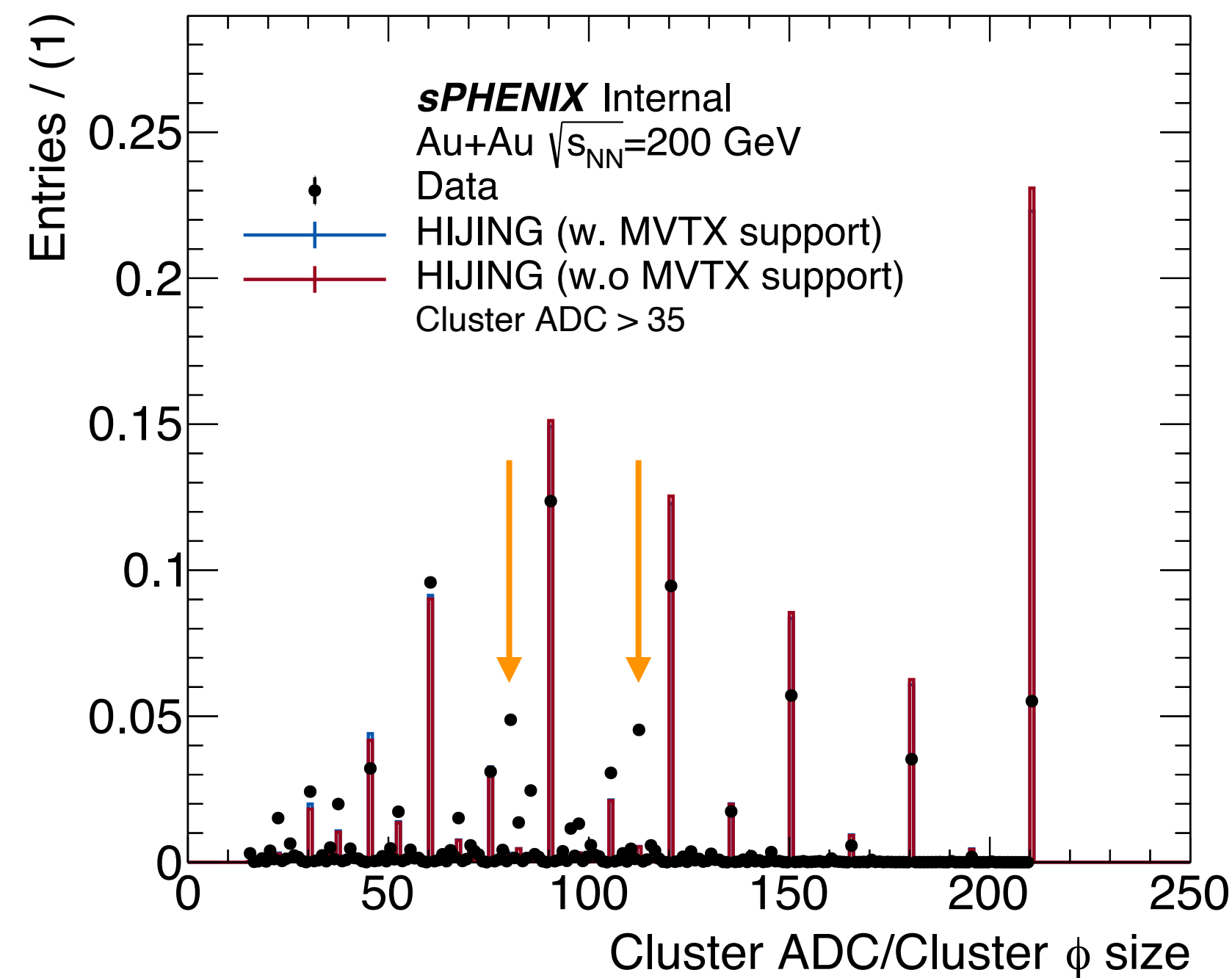
Simulation



Cluster η v.s Cluster ADC/cluster ϕ size

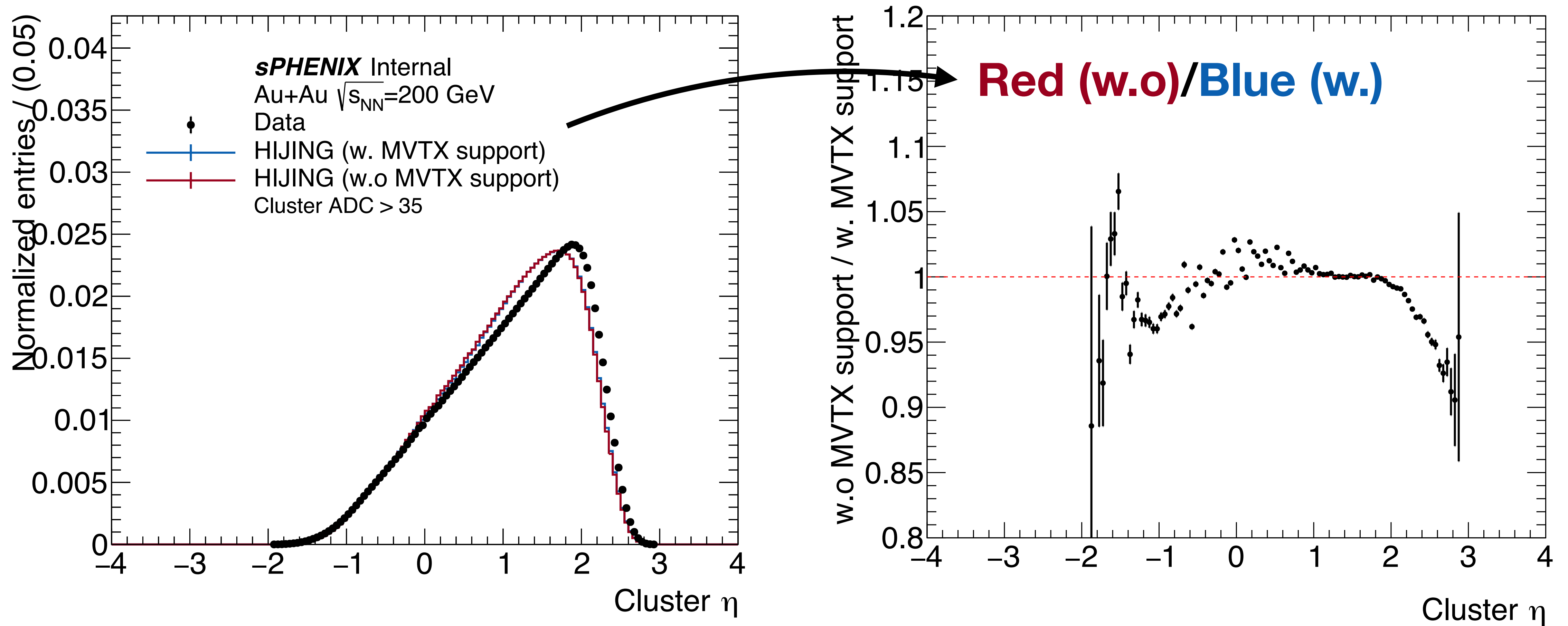


■ If those clusters are removed from data...



With MVTX support v.s Without

- Effect of MVTX material budget, especially the support structure?

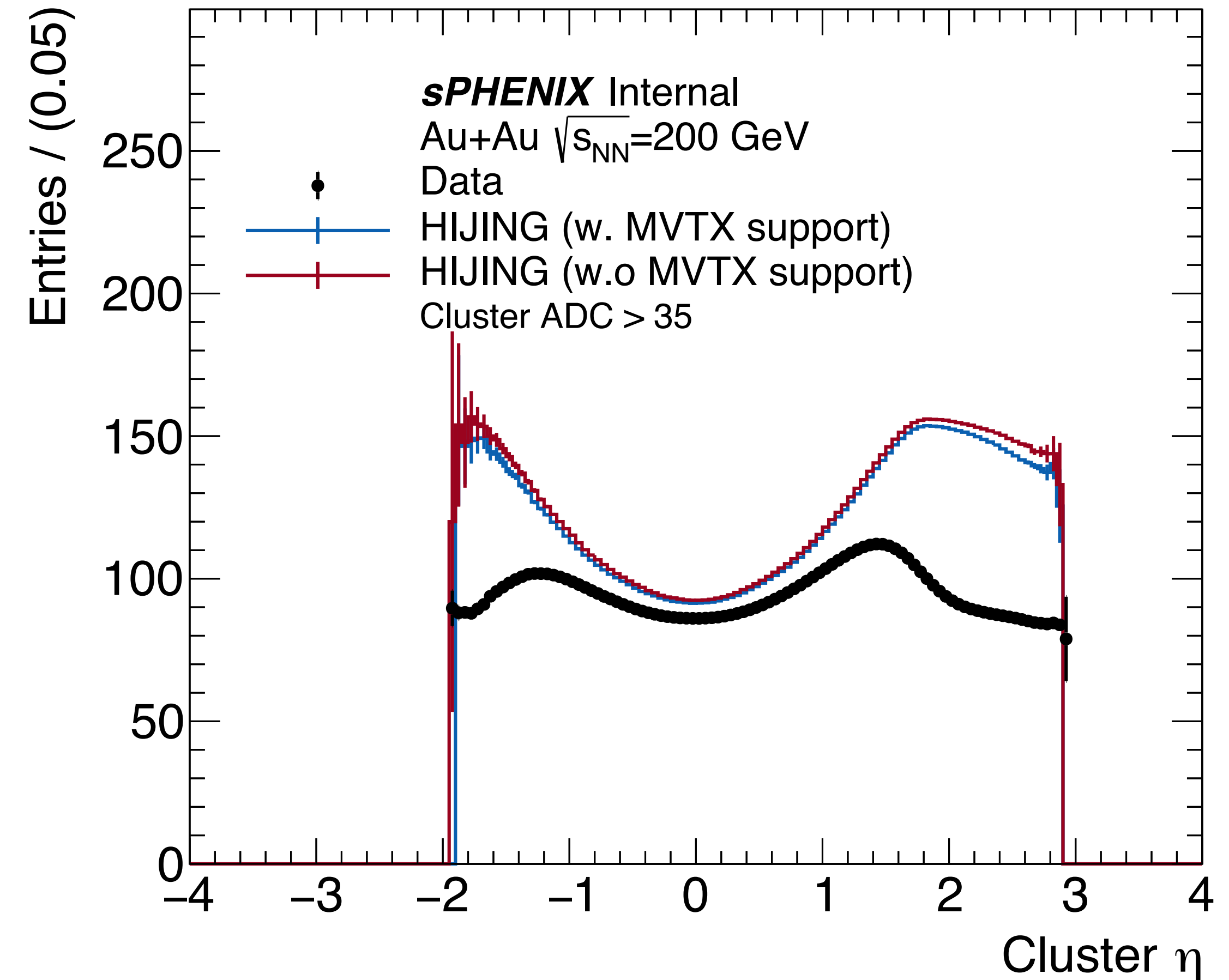


Cluster ADC to ϕ size ratio

■ Y-axis: weighted average of the ratio of cluster ADC and ϕ size (the average ADC value per strip in a cluster) as a function of cluster η

■ Questions:

- What cause the difference between data and simulation?
- What does it look like in Run2024 p+p data and simulation?

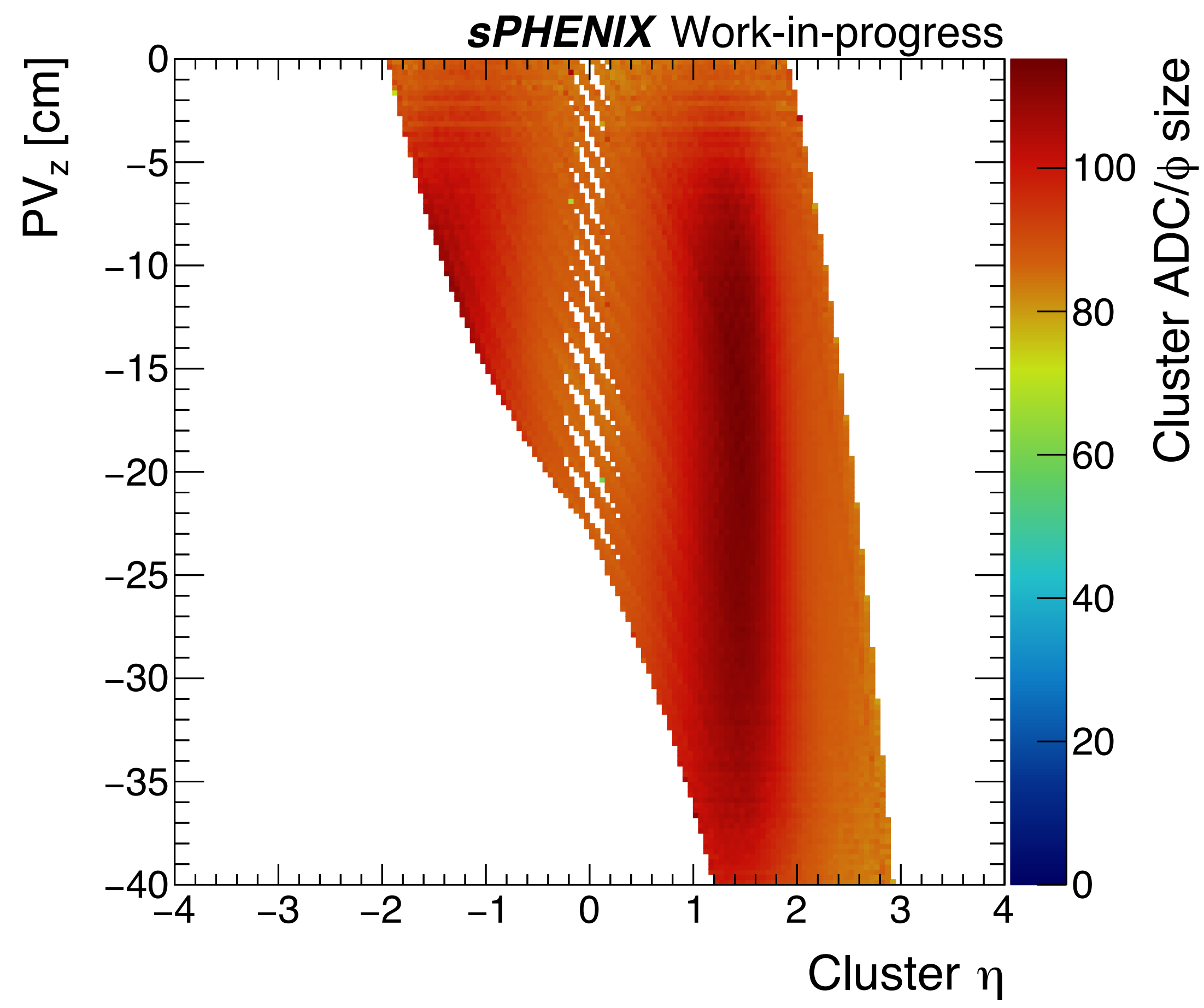


Cluster ADC to ϕ size ratio

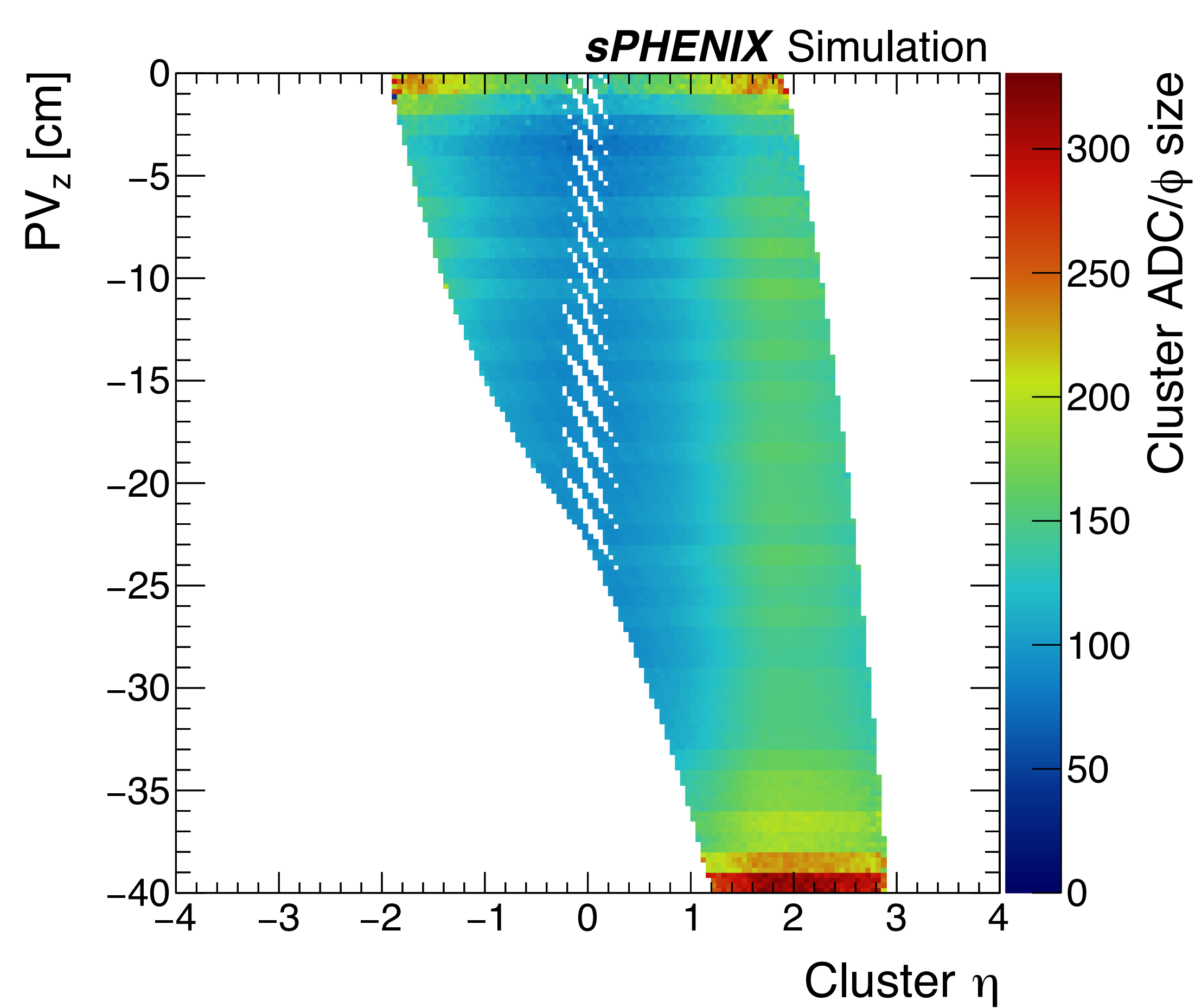


■ Vertex Z position dependence?

Data



Simulation



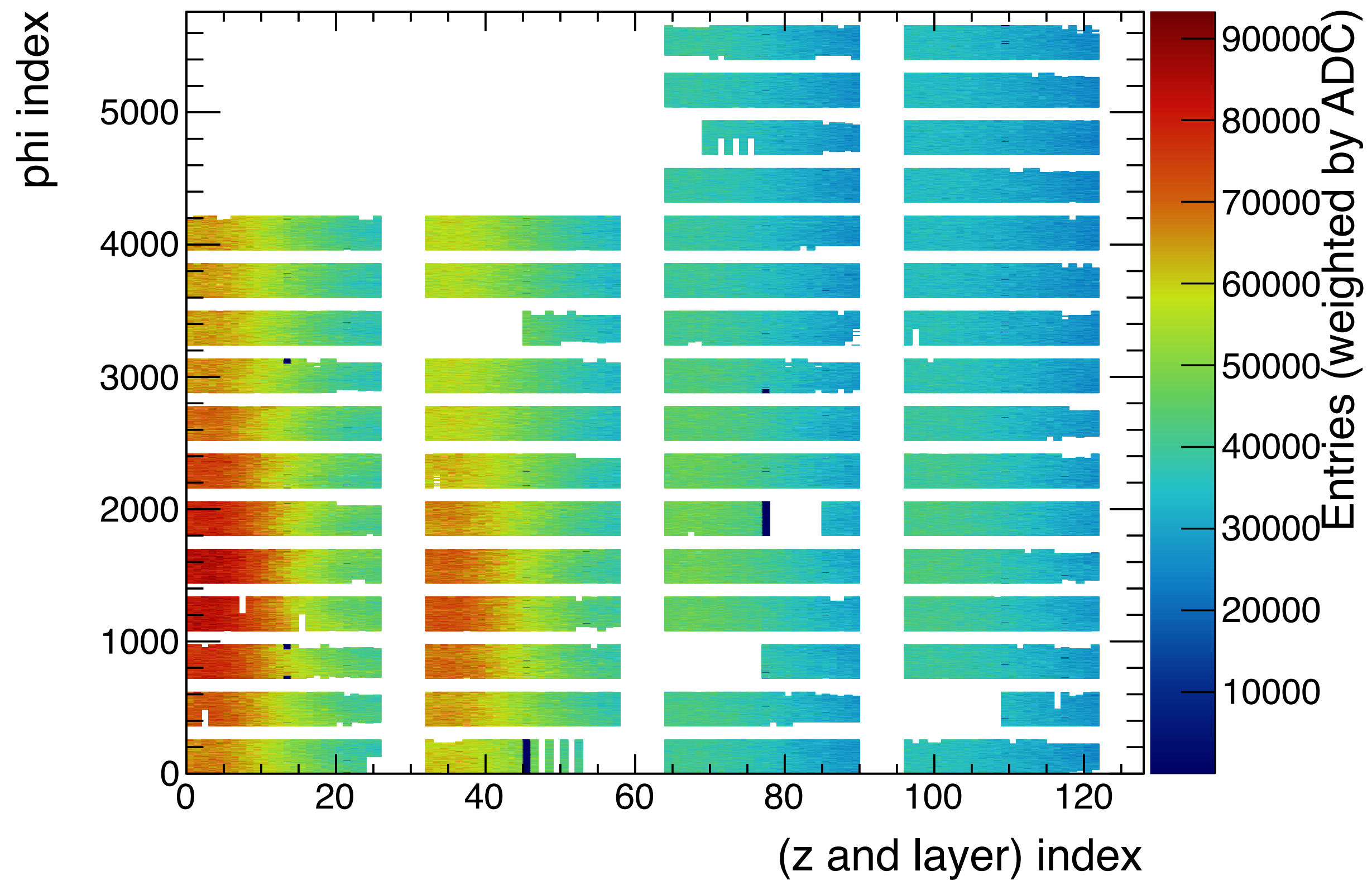
- Discrepancies between data and simulation in Run2023 Au+Au
- Non-collision clusters with unknown sources
 - Low cluster ADC at $\eta \sim 2$: removed by the constant ADC cut > 35
 - Cluster ADC/ ϕ size = [79,82] and [111,114] also at $\eta \sim 2$: a simple cut to remove these seems excessive
- The average ADC value per strip in a cluster is much lower in data than in simulation
- Run2024 p+p data and simulation?

Backup

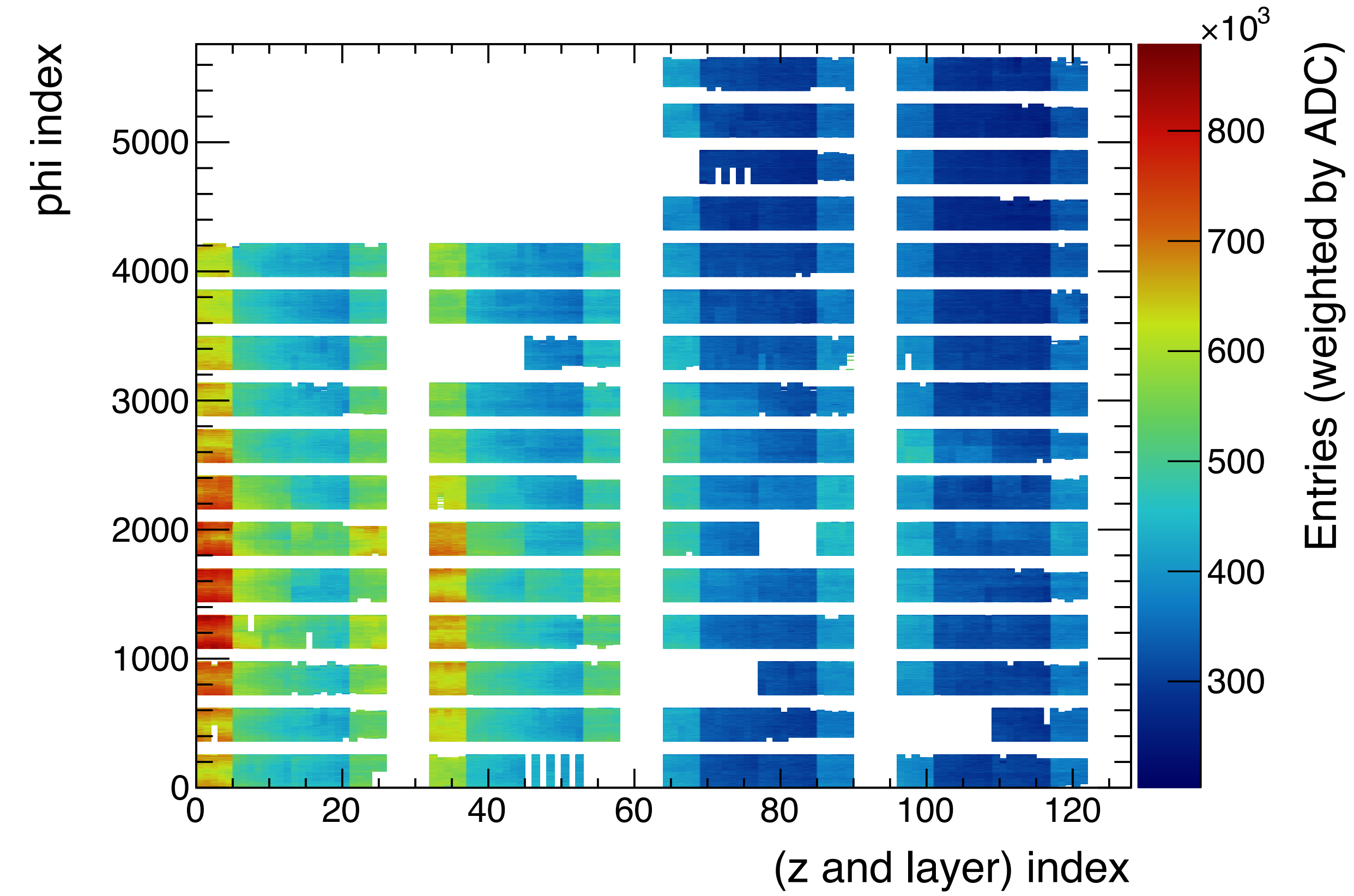
Unrolled hitmap



Simulation



Data

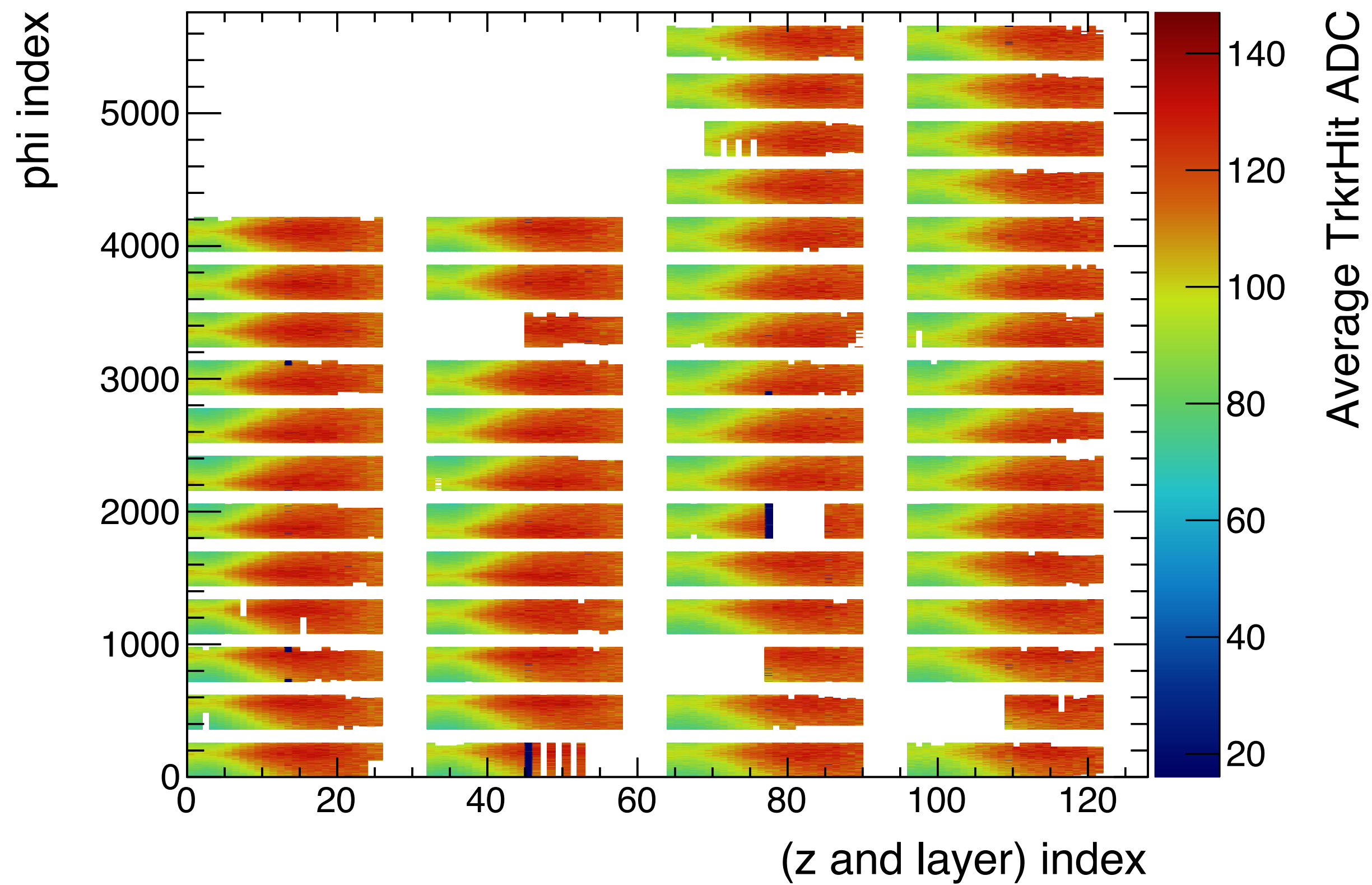


*Using Michael's code to calculate the unrolled indices

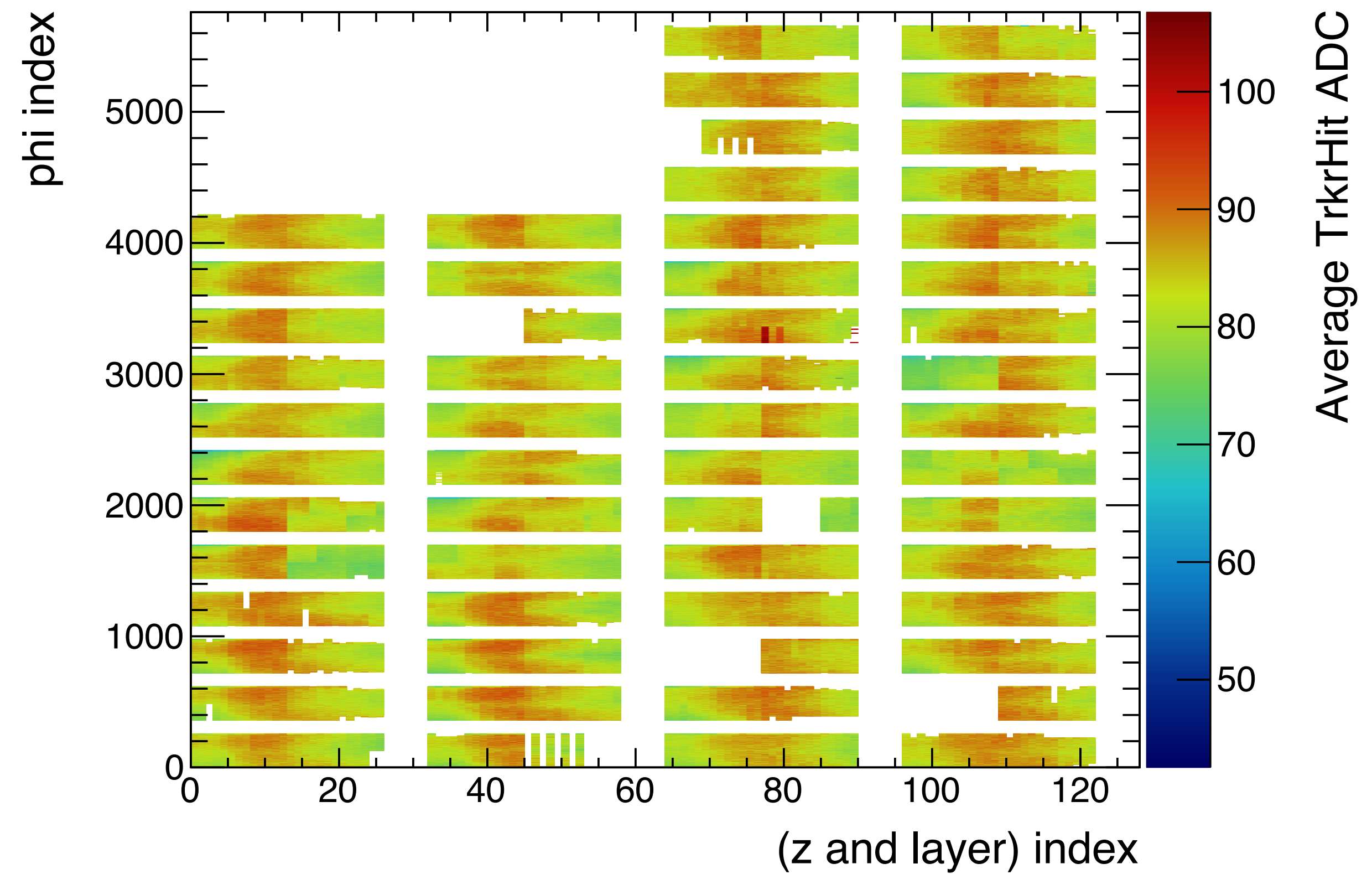
Unrolled hitmap



Simulation

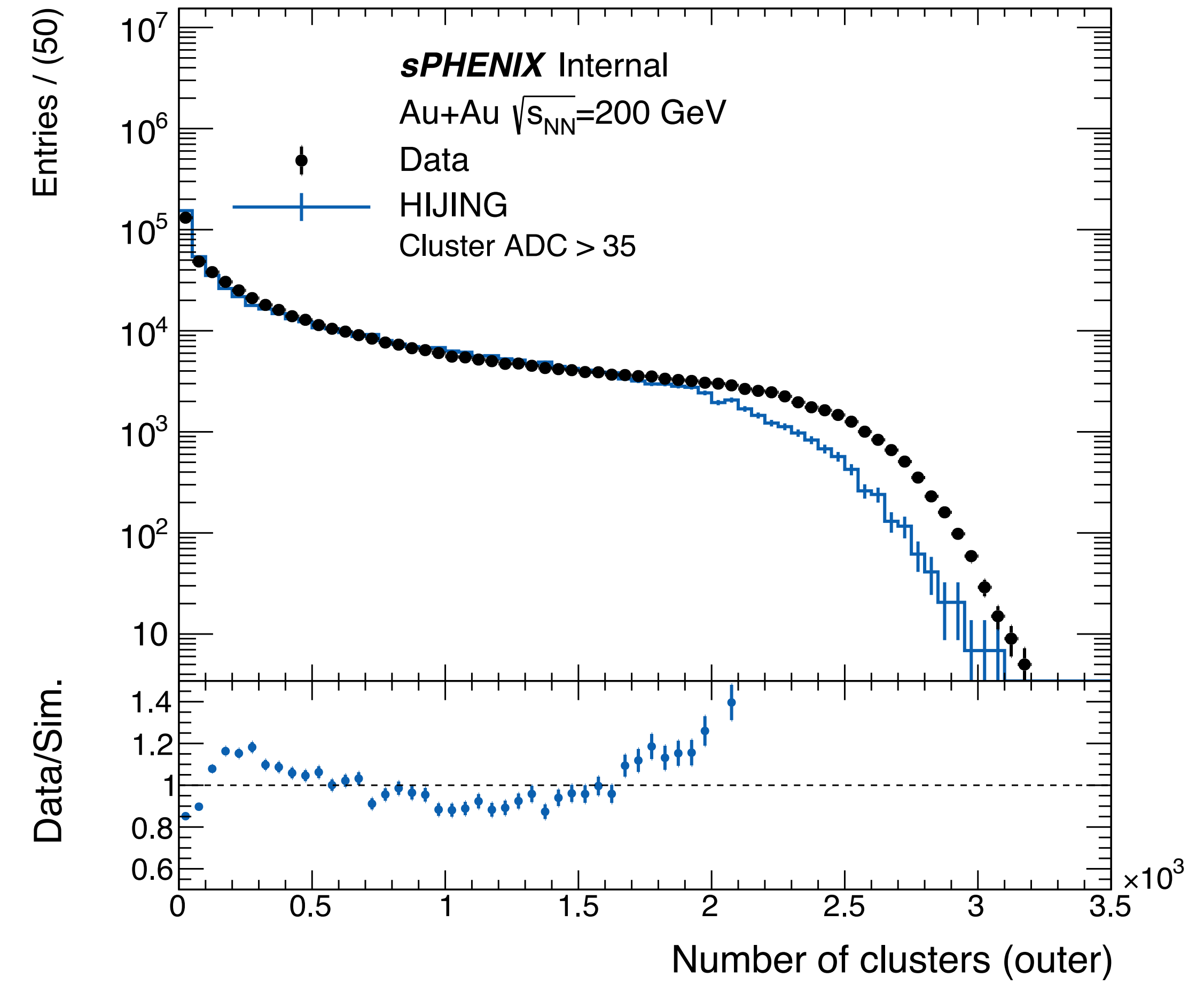
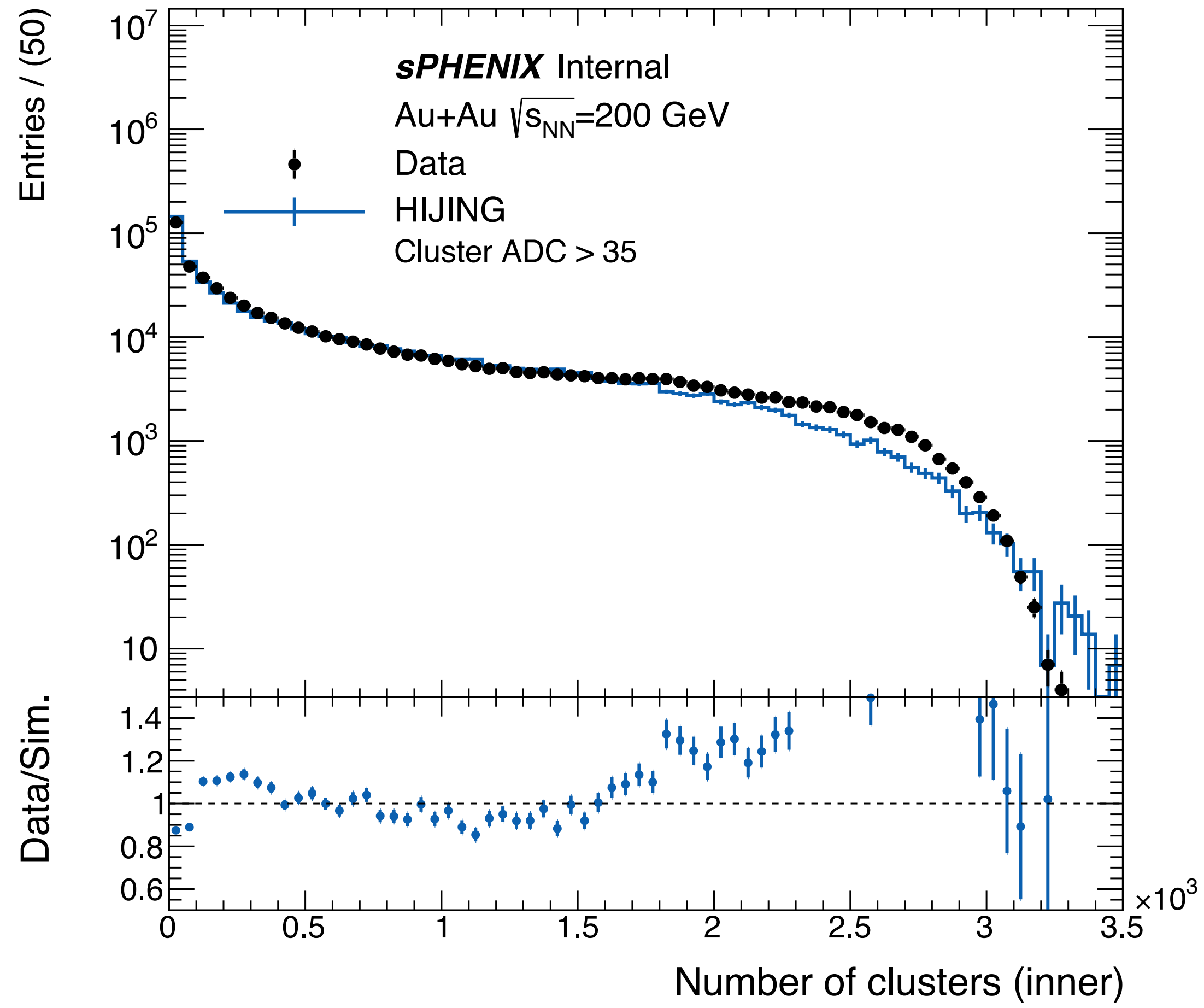
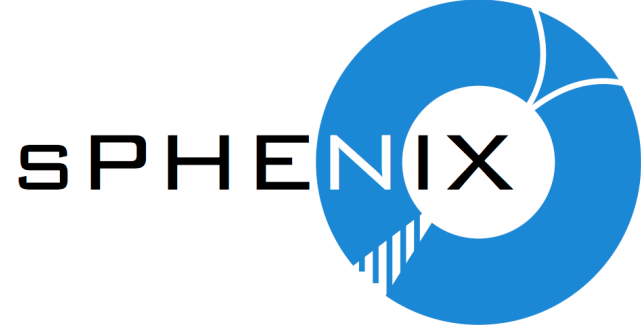


Data

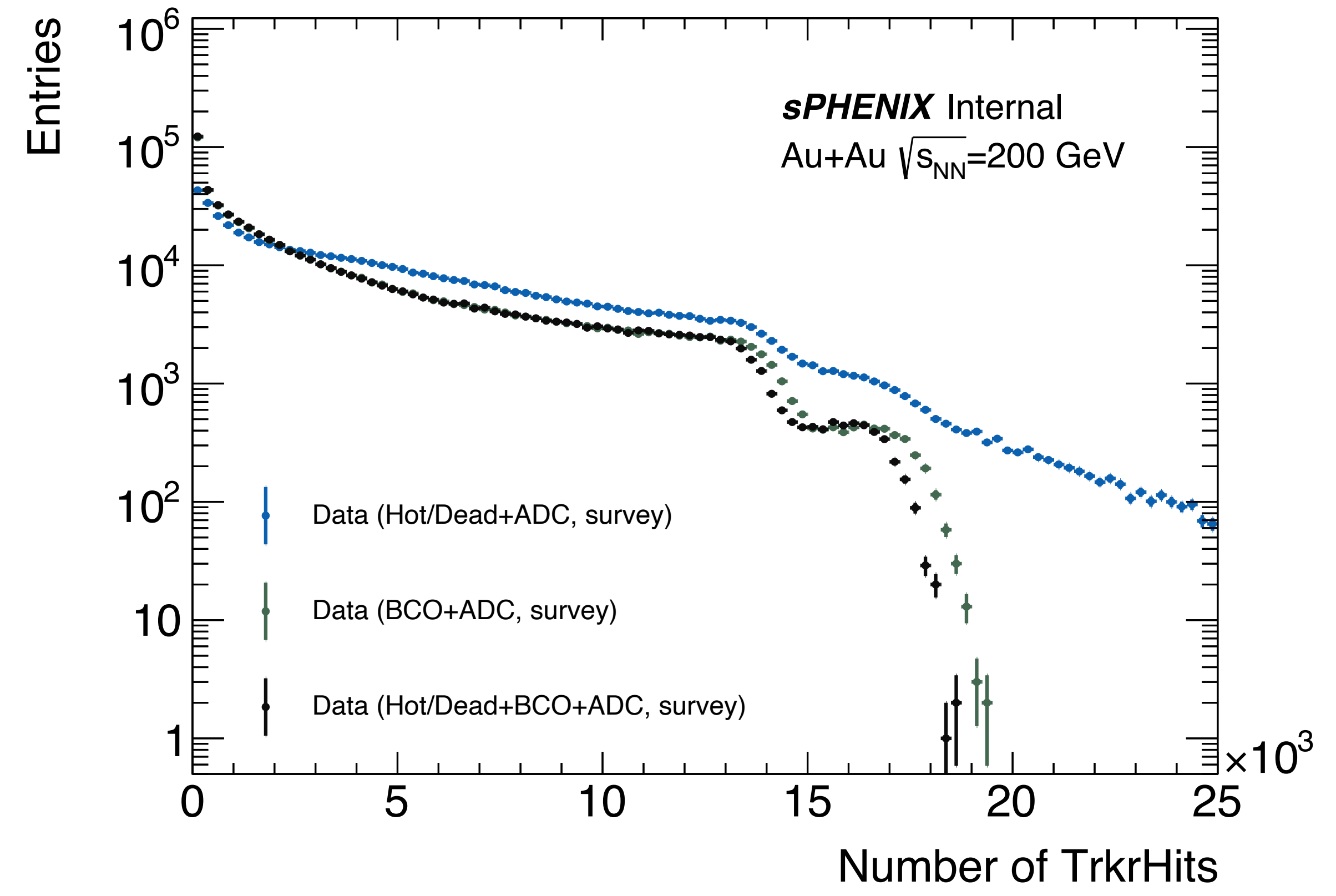
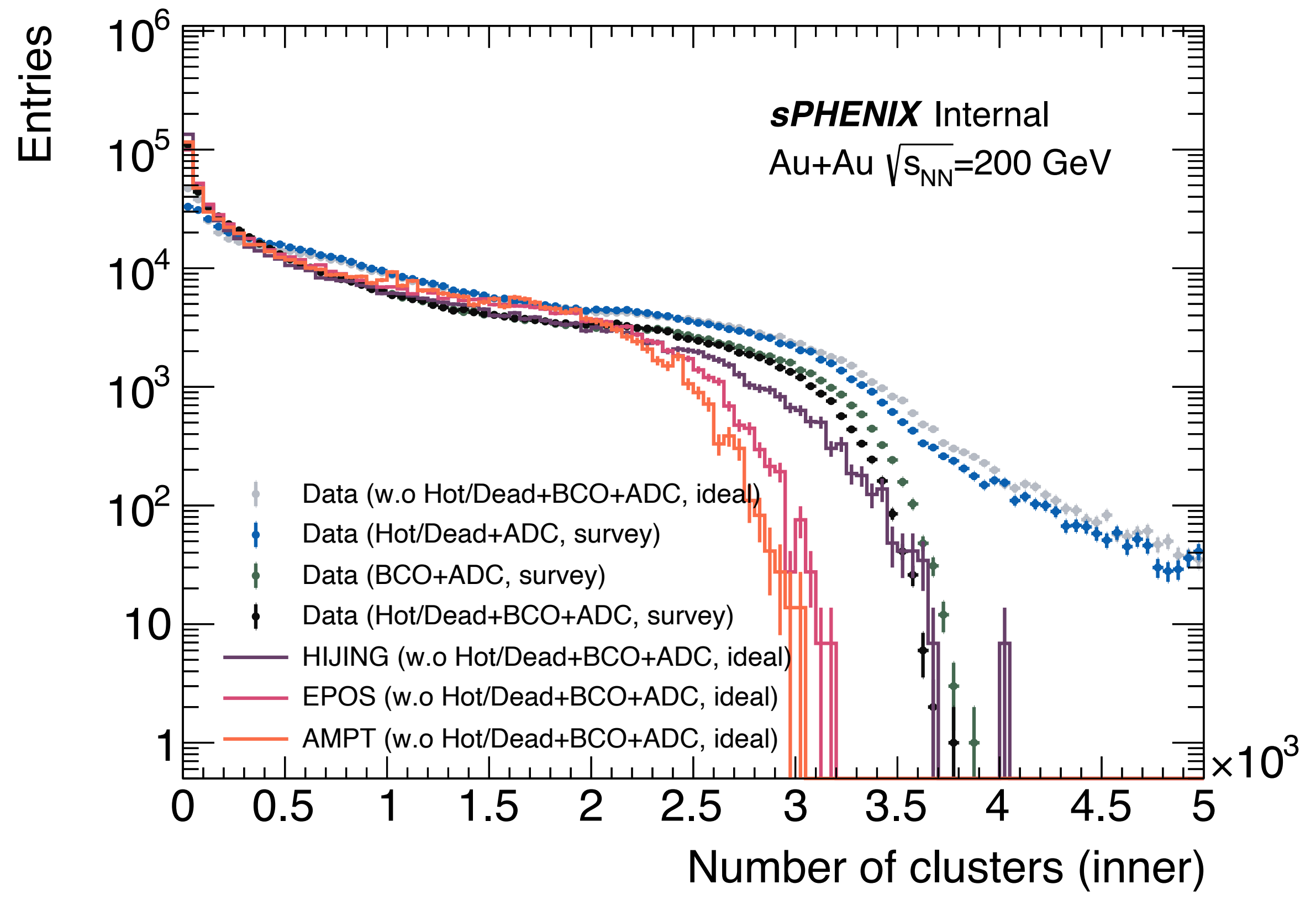


*Using Michael's code to calculate the unrolled indices

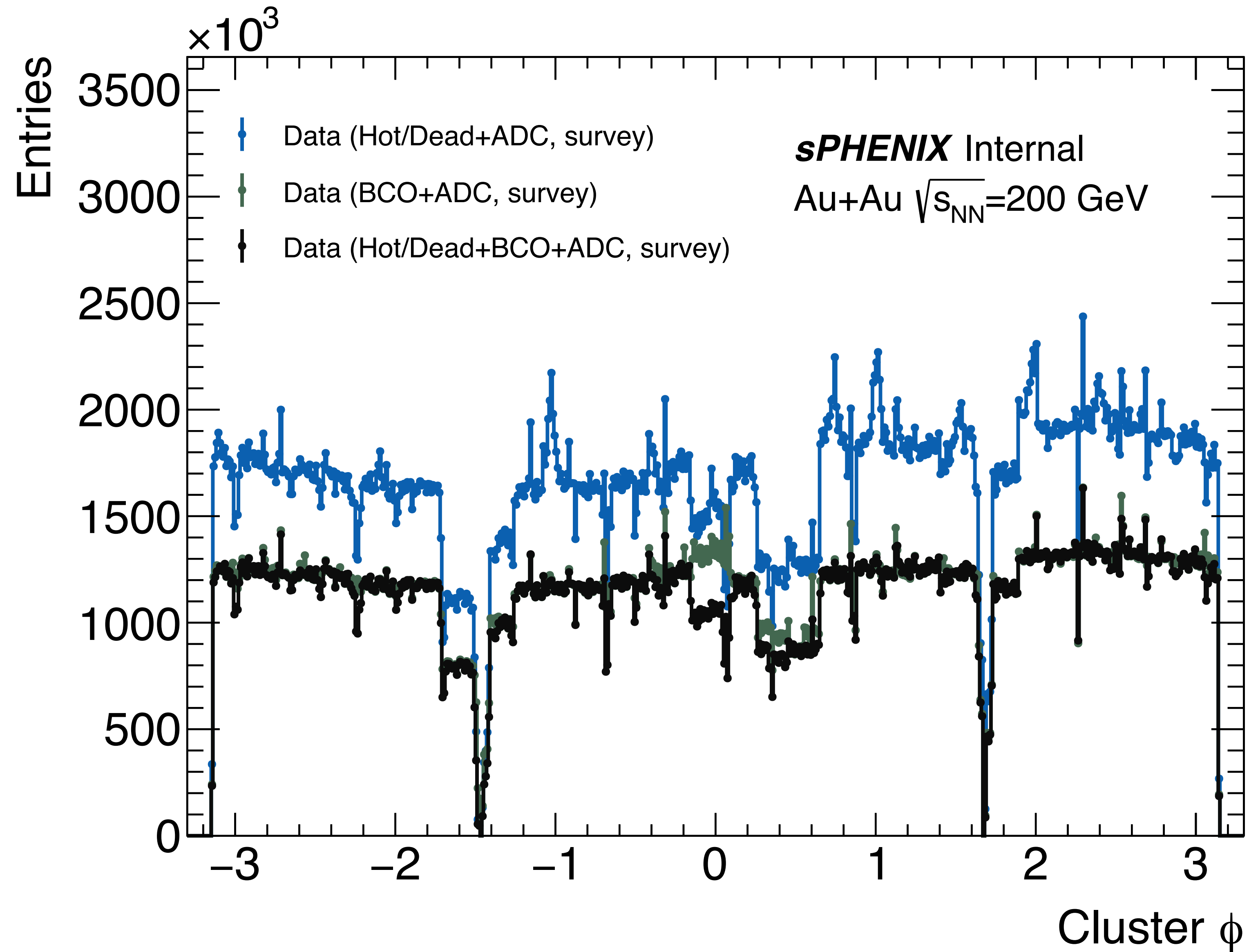
Cluster distributions - # of clusters



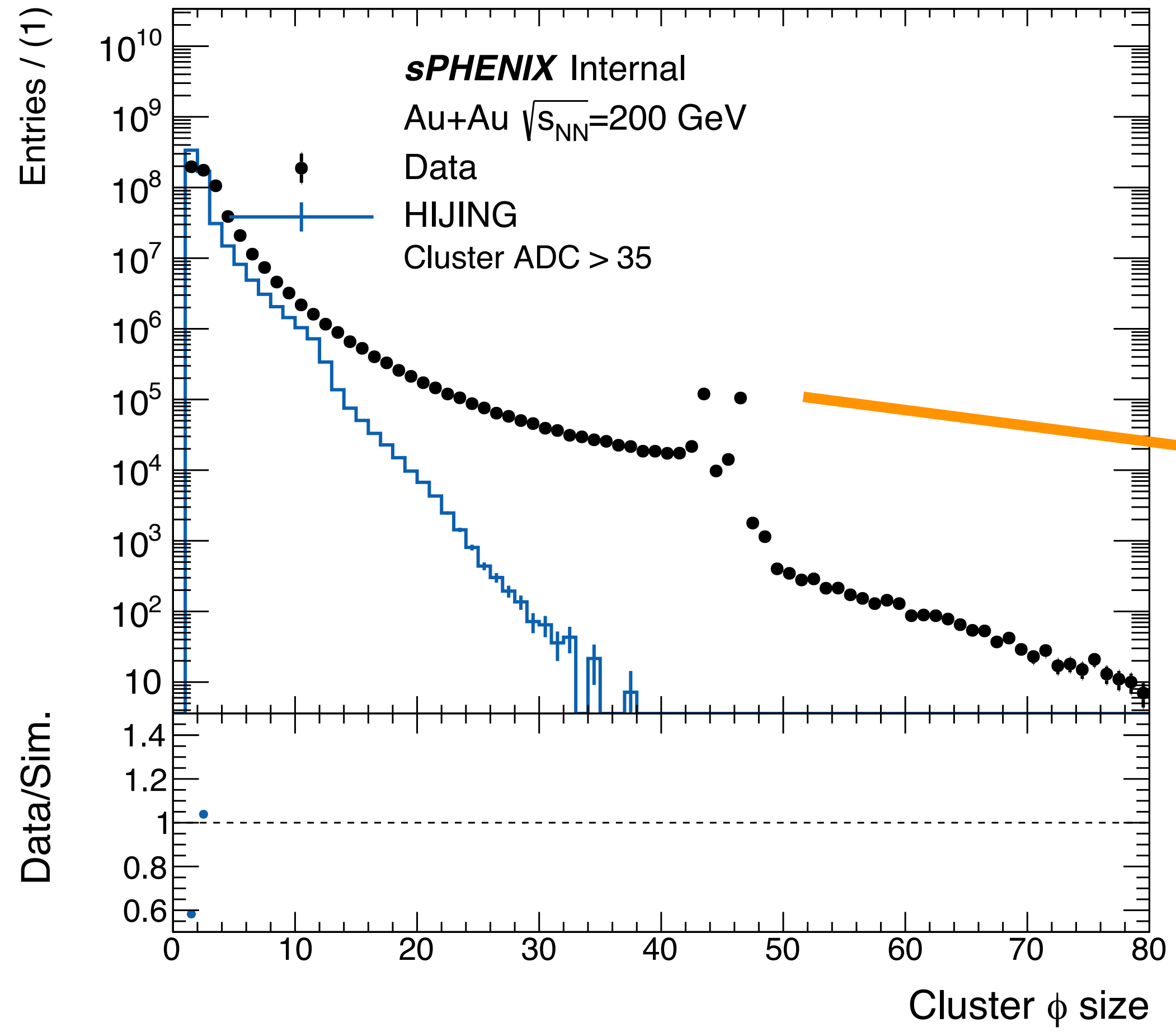
Number of clusters in data



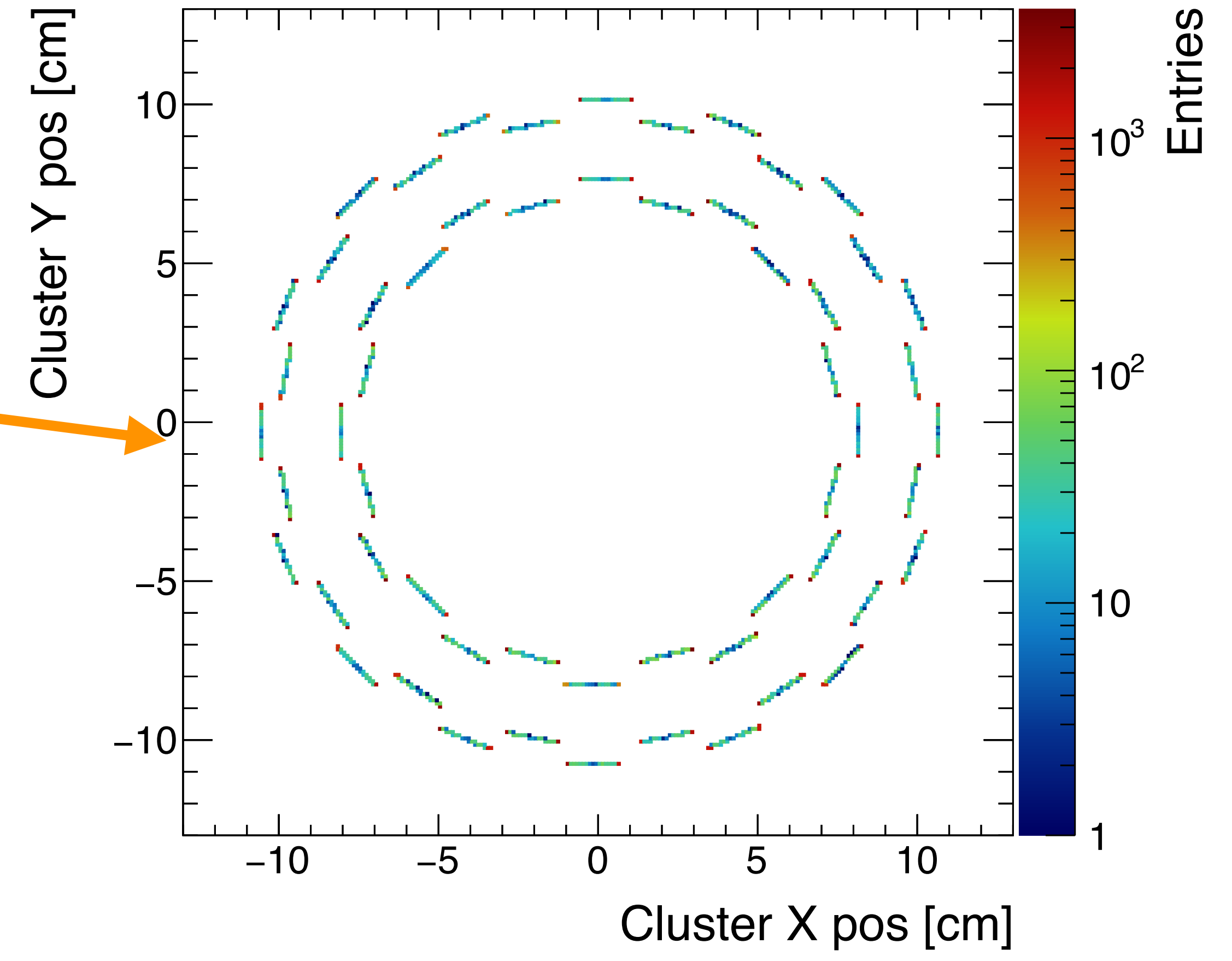
Cluster ϕ distribution in data



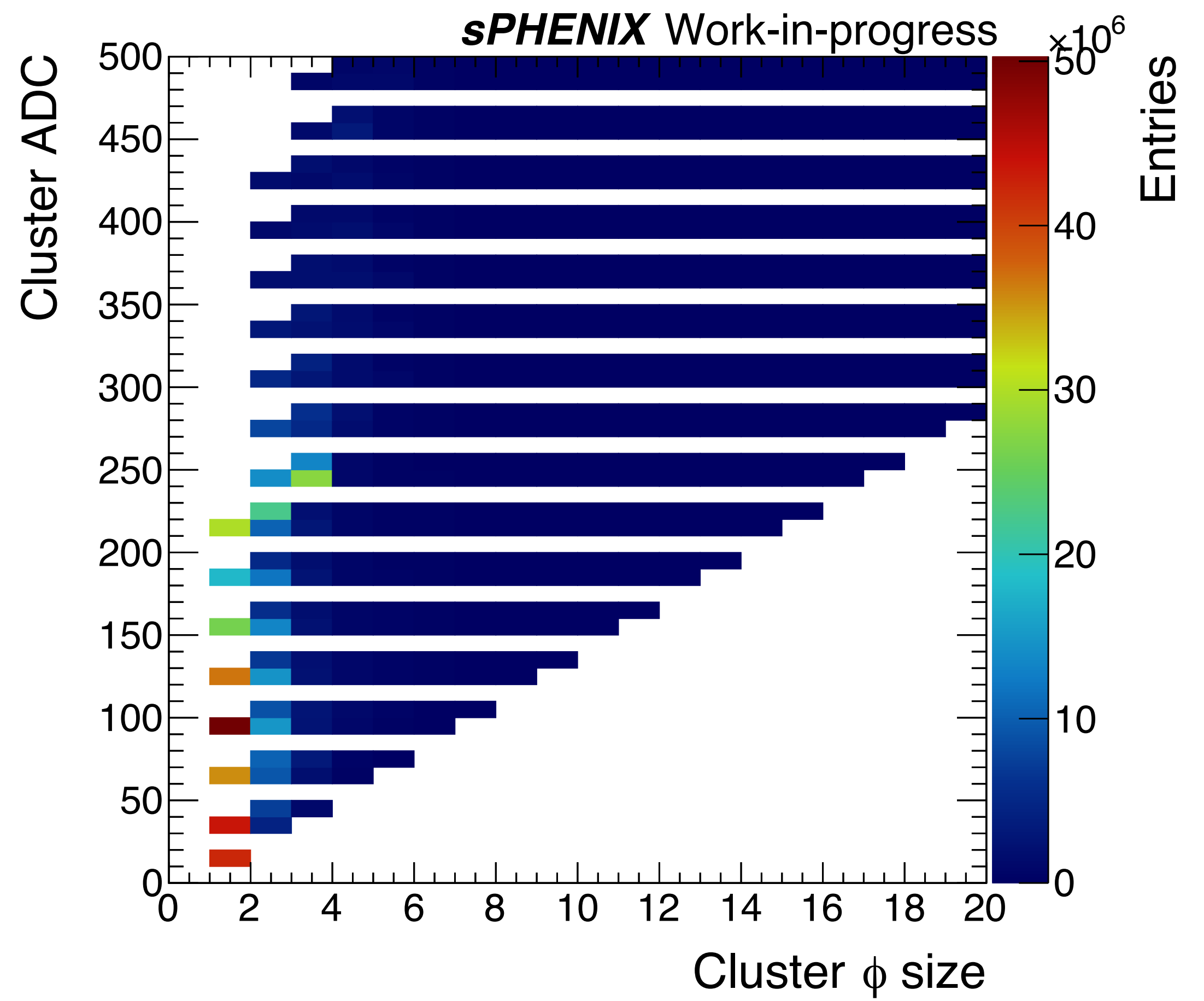
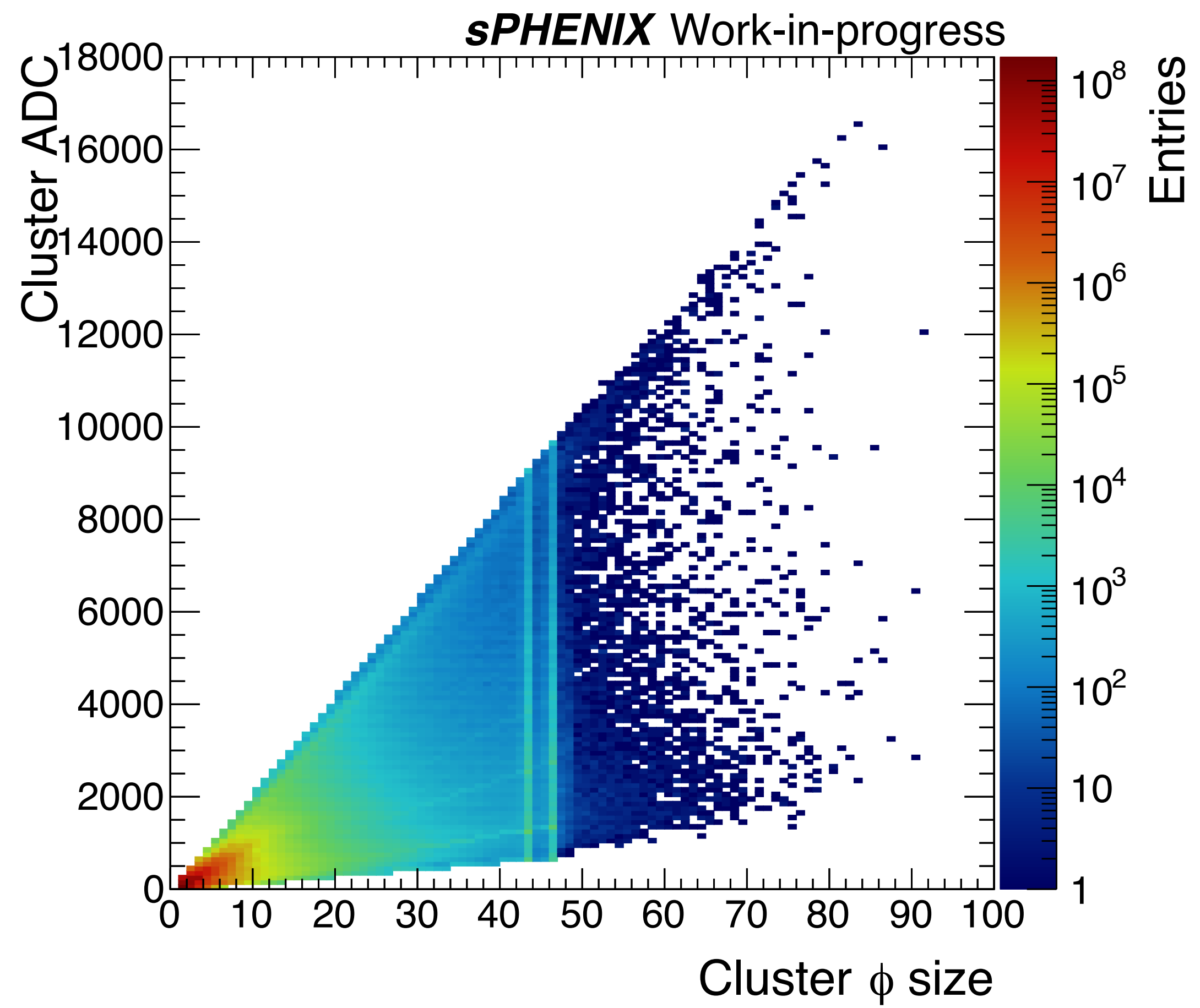
Cluster distributions



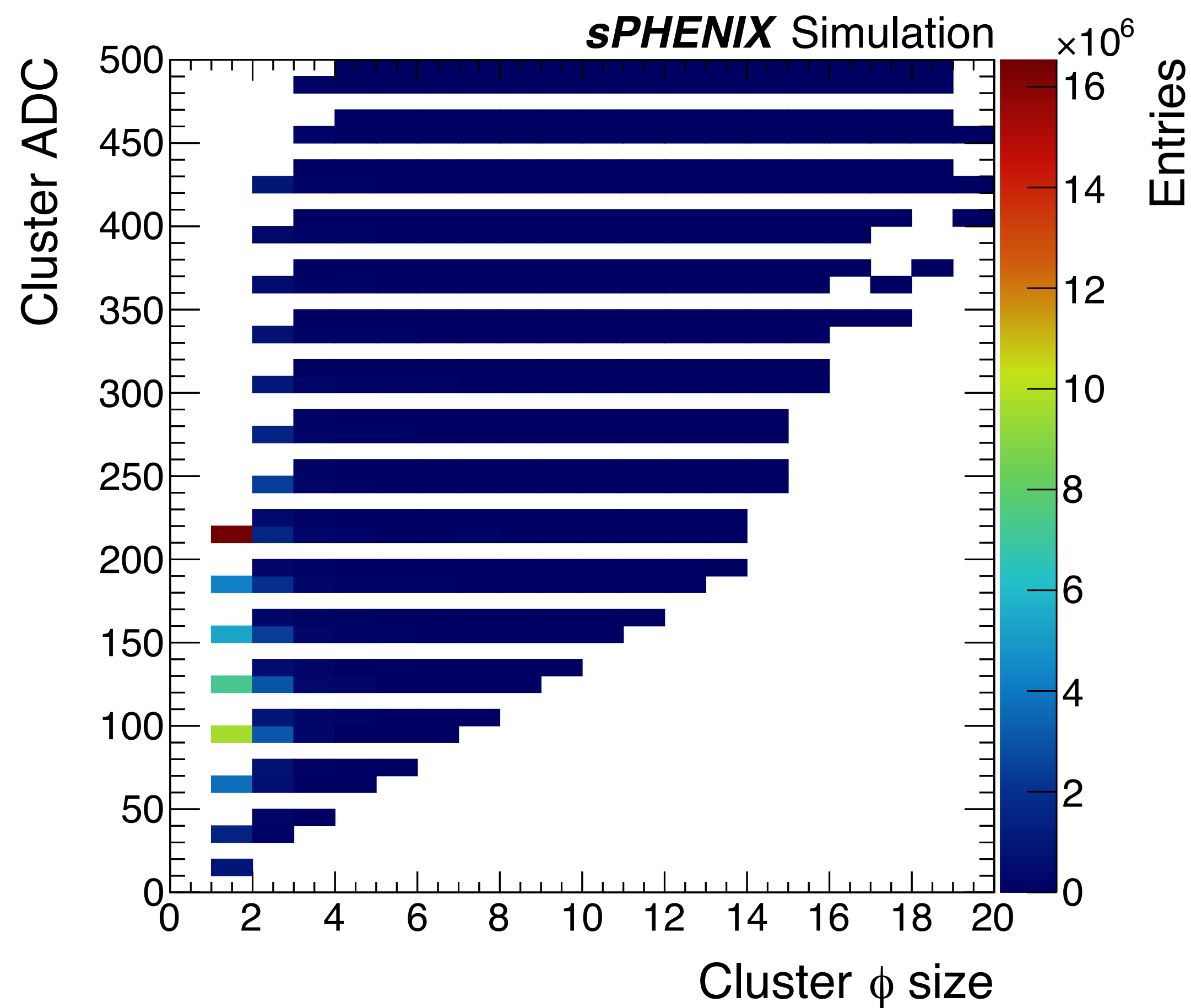
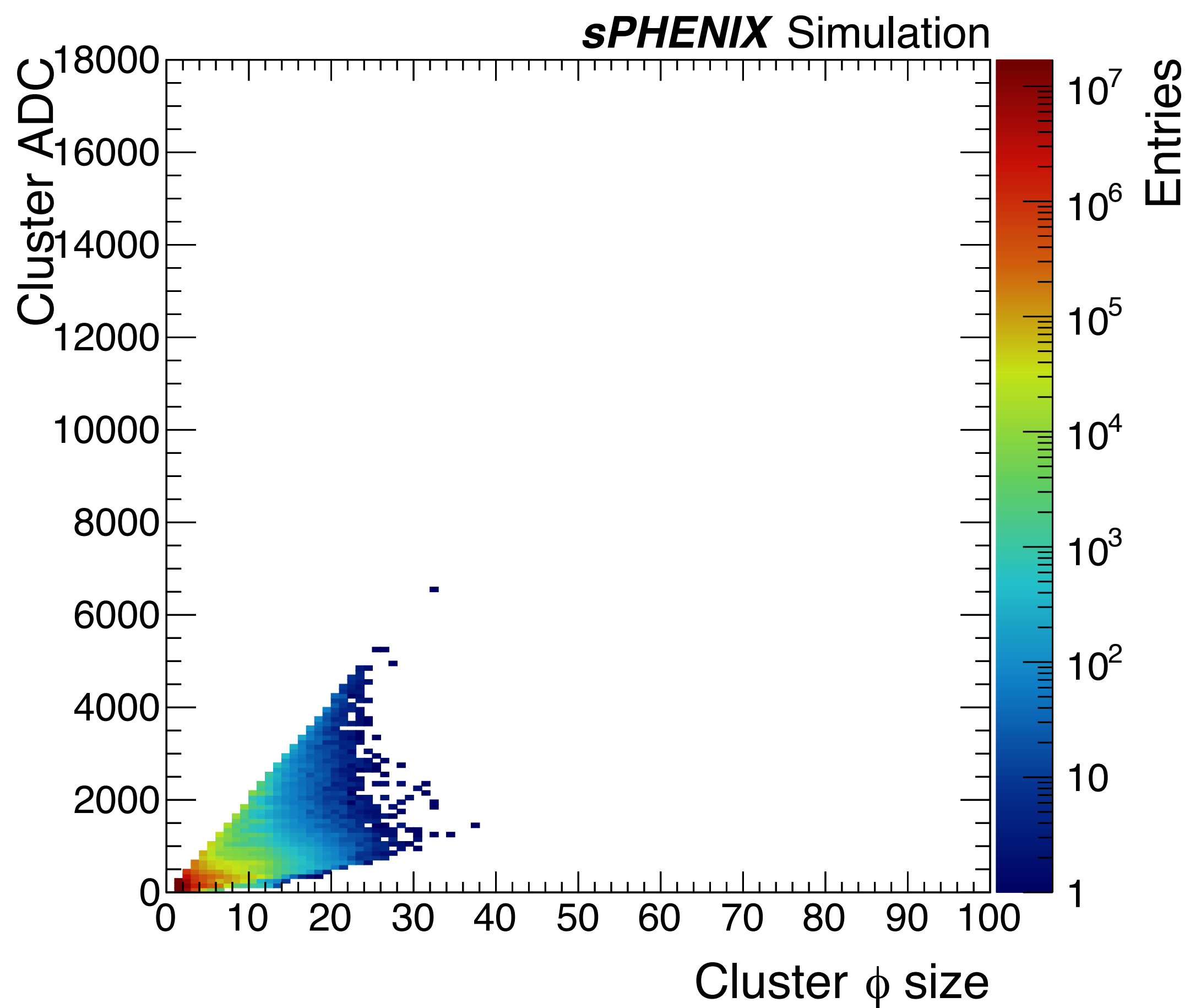
Data, cluster ϕ size = 43 or 46



Cluster ϕ size v.s ADC in data



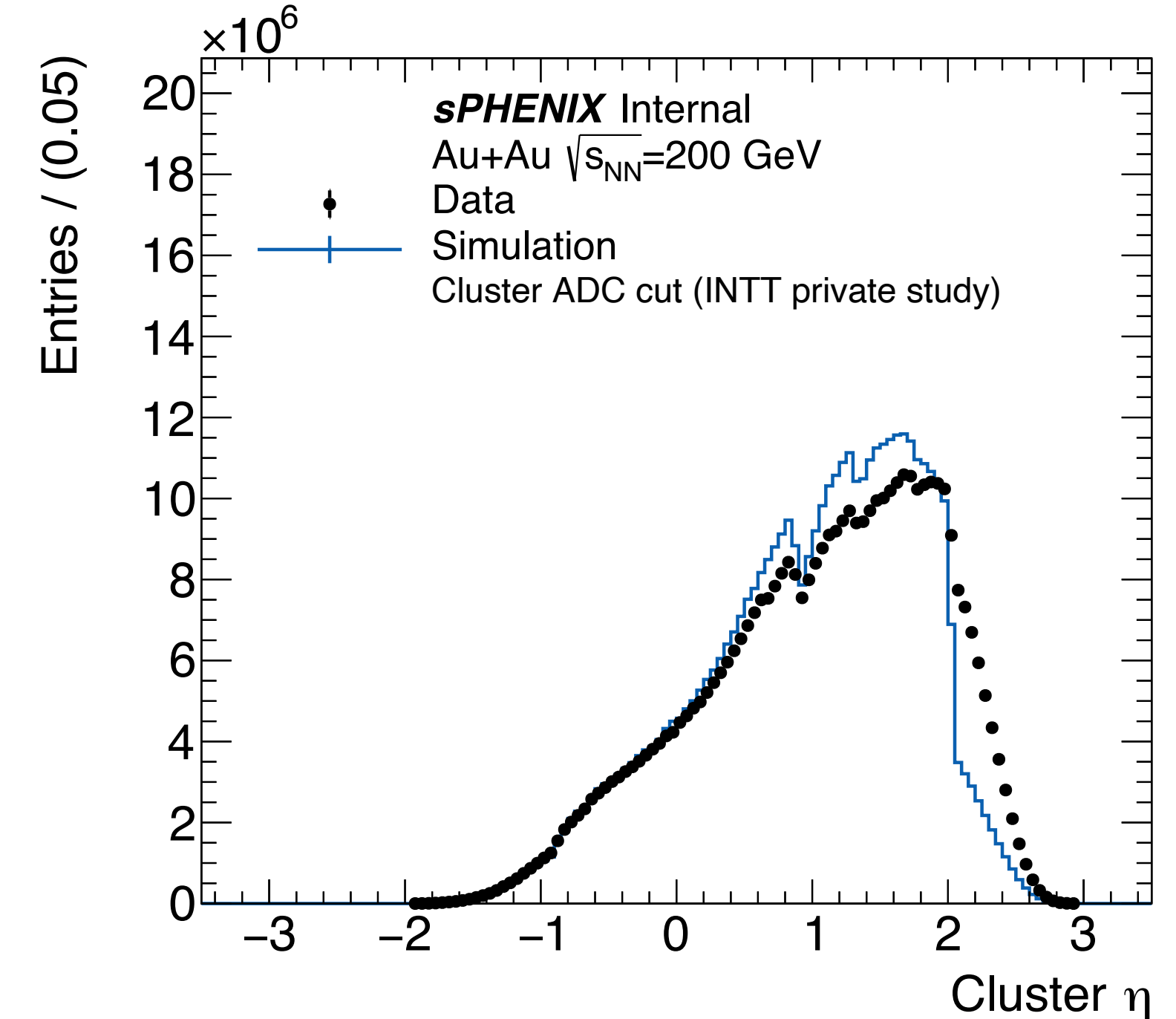
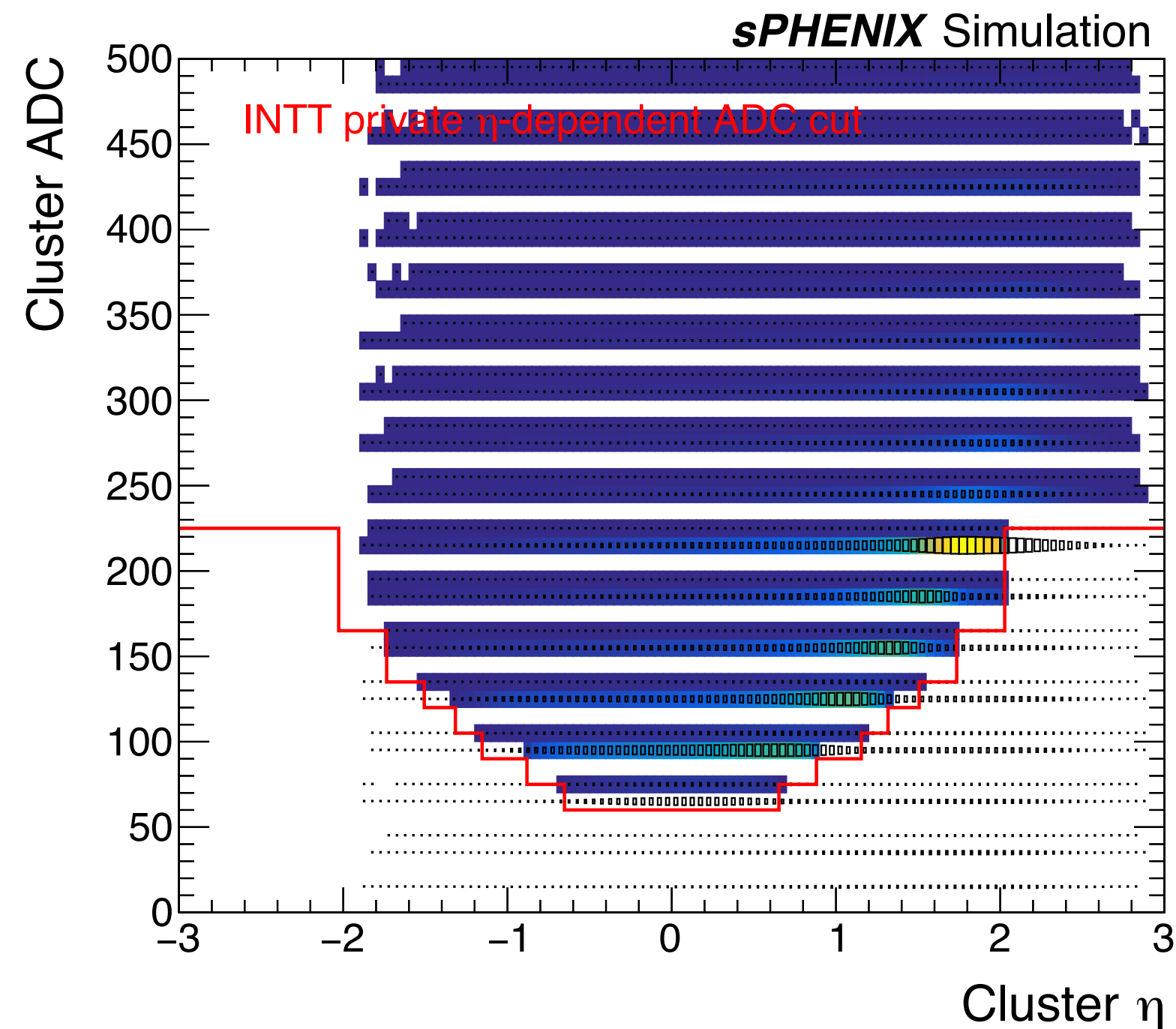
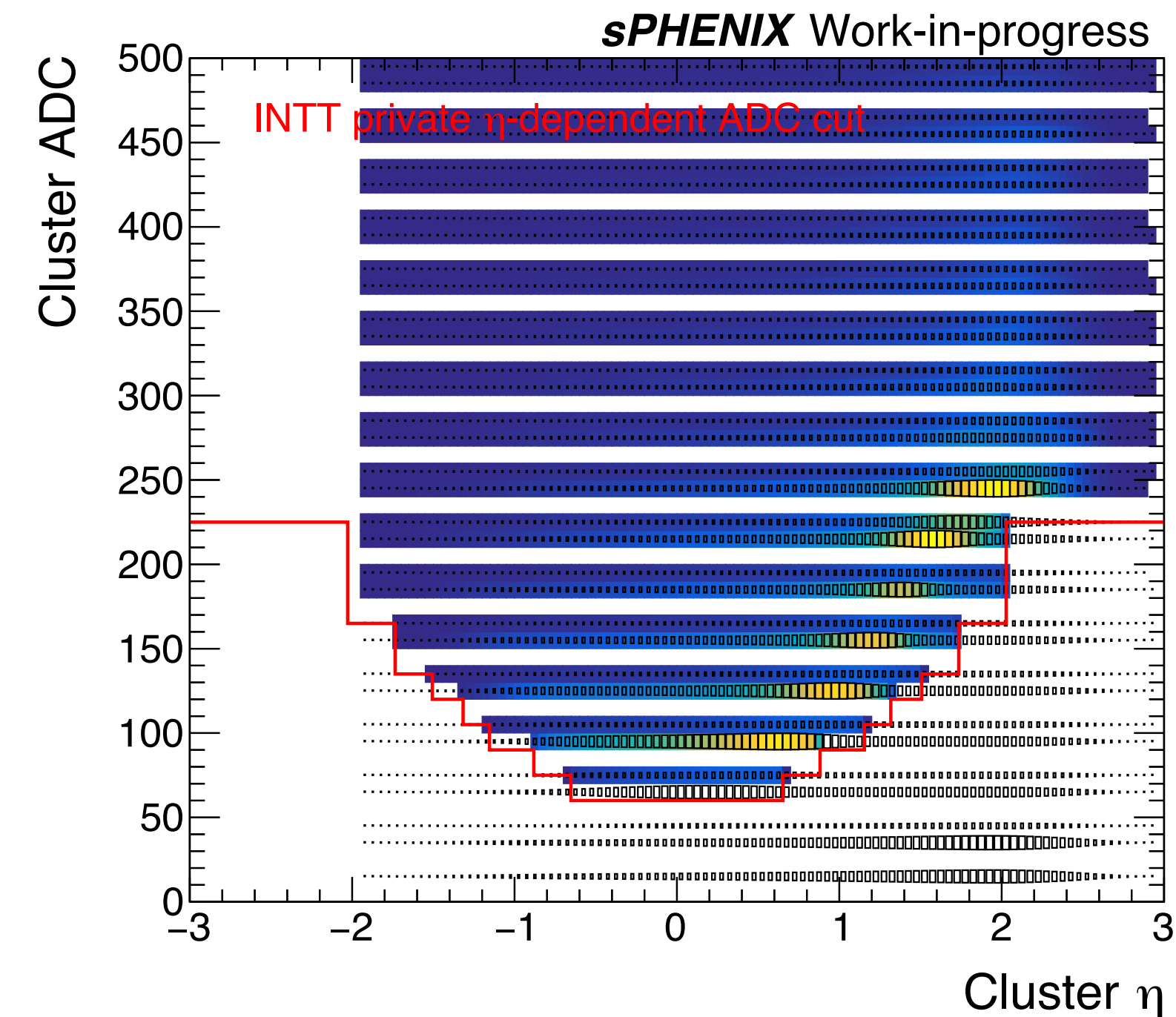
Cluster ϕ size v.s ADC in simulation



η -dependent cluster ADC cut

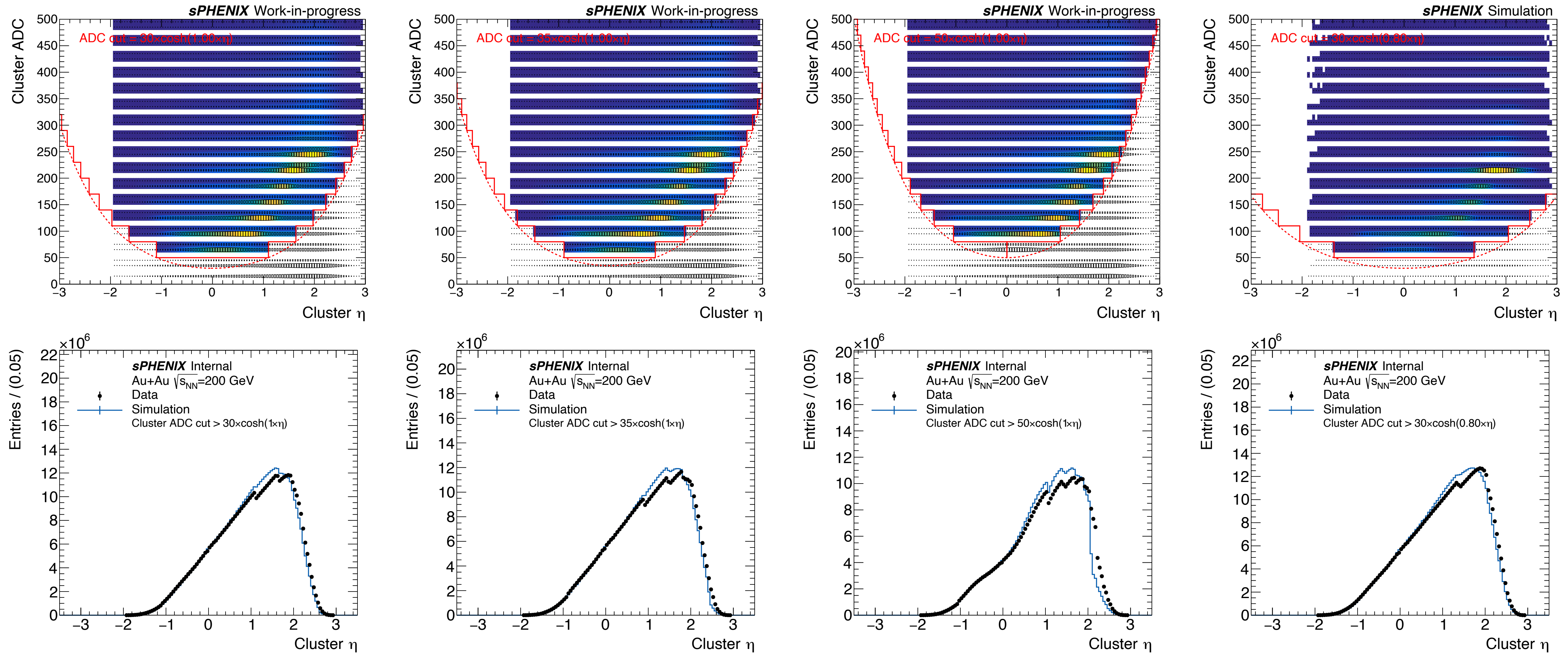
■ The initial set of θ -dependent cluster ADC proposed by the INTT team was applied to both data and simulation

□ Unnatural discontinuity in the cluster η distributions in both data and simulation



η -dependent cluster ADC cut

ADC cut with hyperbolic function with different parameters



Z vertex reweight

