# $\phi$-meson global spin alignment update

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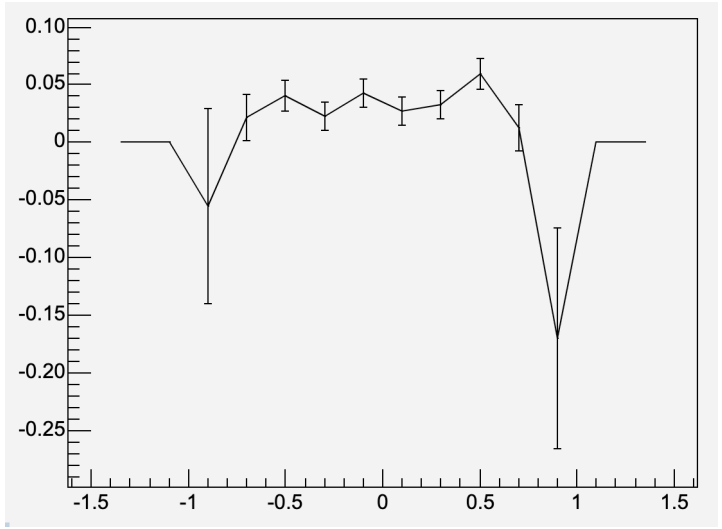
07/13/2023

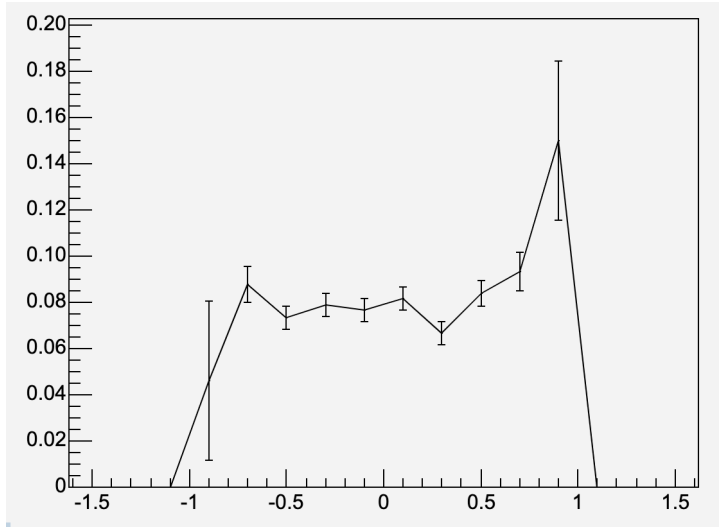
# Points to Follow Up from Last Meeting

- Using rapidity dependent $v_2$ in simulations of efficiency+acceptance.
  - Motivation: Incorrect $v_2$ can have a significant effect on rapidity dependent $\rho_{00}$ (seen in simulation).
- Try acceptance simulation for $0.8 < |y| < 1.0$.
  - Motivation: maybe a symmetric cut will reduce difference between input and output.
- Include β' terms in the fitting of acceptance correction.
  - Motivation: <cos2β'> and <cos4β'> were found to be non-zero when η cut is present.
- Look into $p_T$ dependent η cut study after fixing auto-correlation.
  - Motivation: There was a large difference between different η cuts, not observed before the fix.
  - η cut study performed for 27GeV BES-I showed there was no difference after correction.

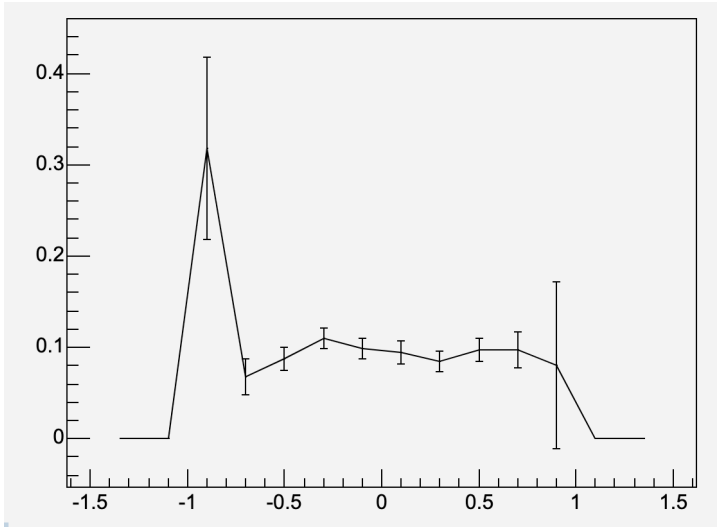
0-10%, $1.0 < p_T < 2.0$ GeV/c



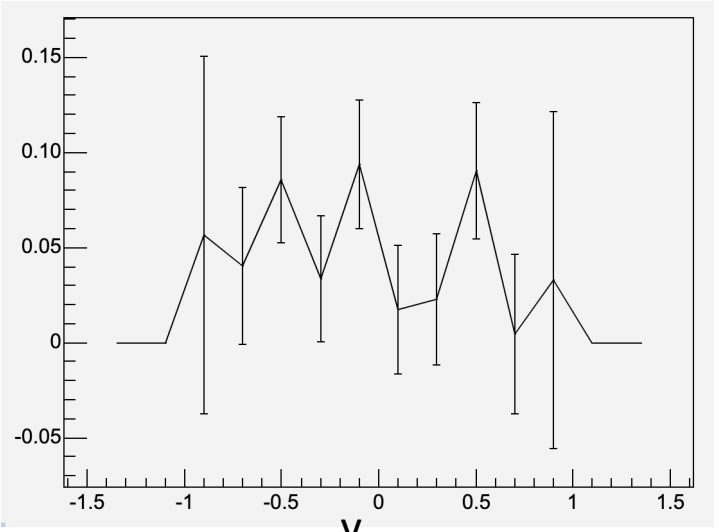

10-40%, $1.0 < p_T < 2.0$ GeV/c



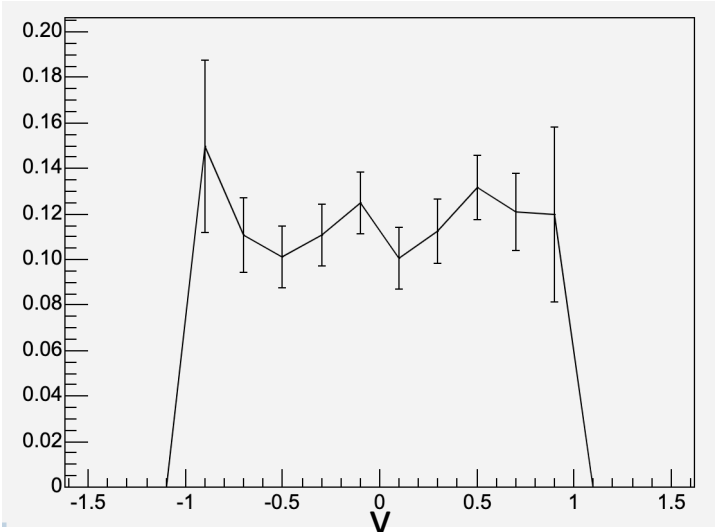

40-80%, $1.0 < p_T < 2.0$ GeV/c



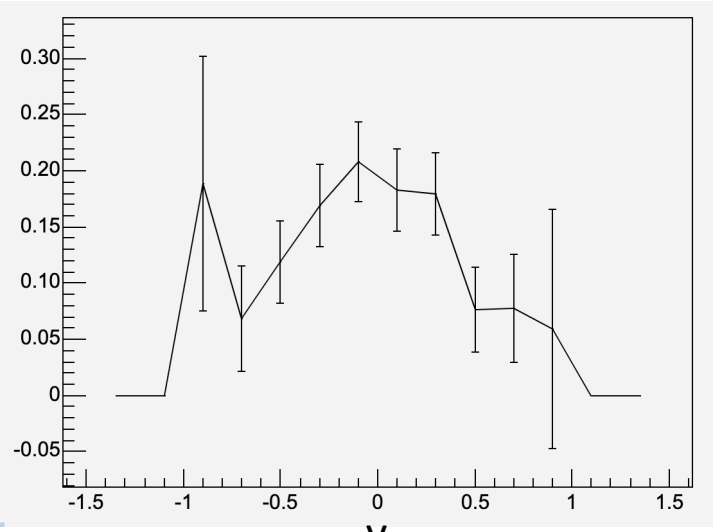

0-10%, $2.0 < p_T < 5.0$ GeV/c

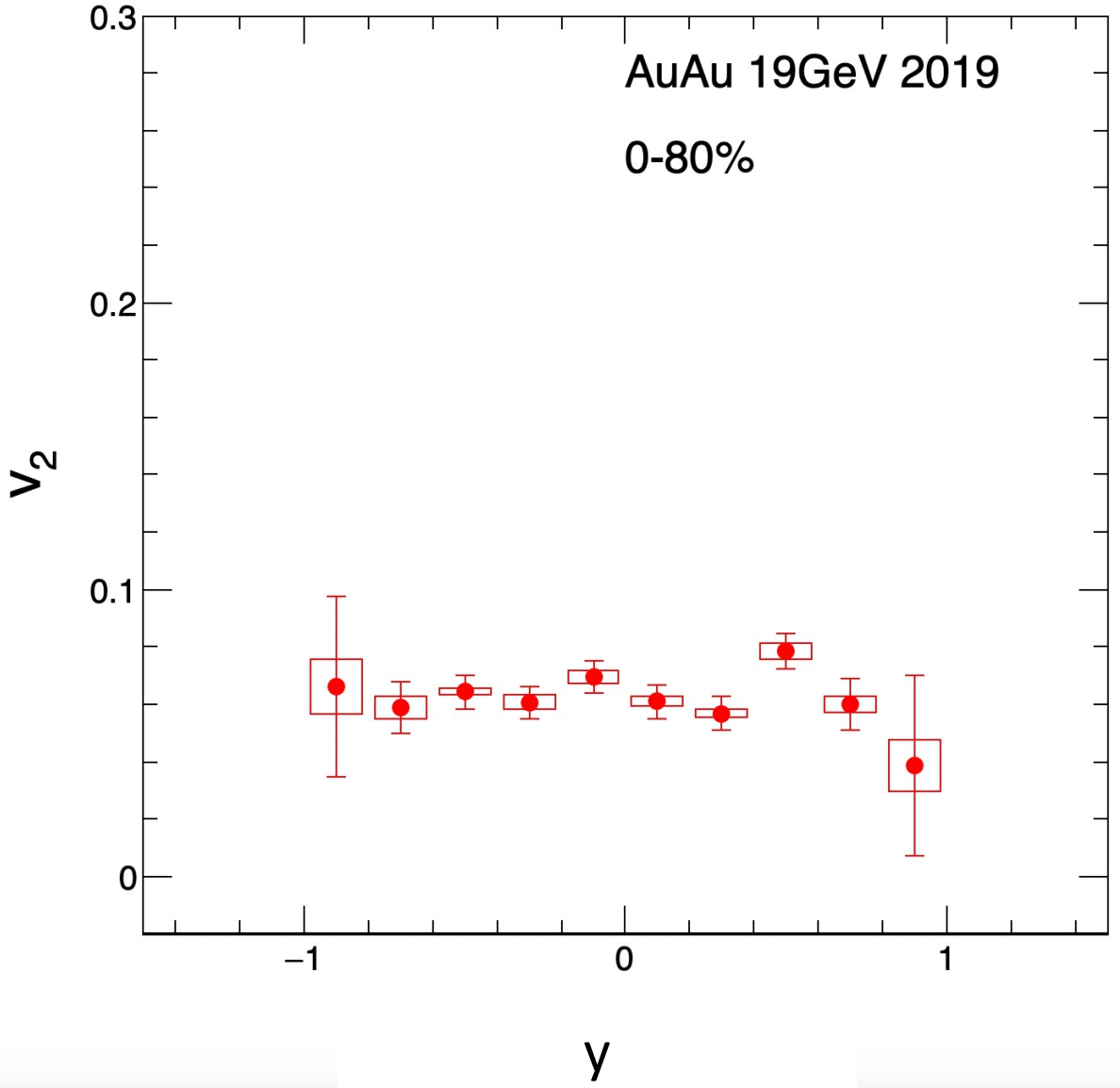



10-40%, $2.0 < p_T < 5.0$ GeV/c



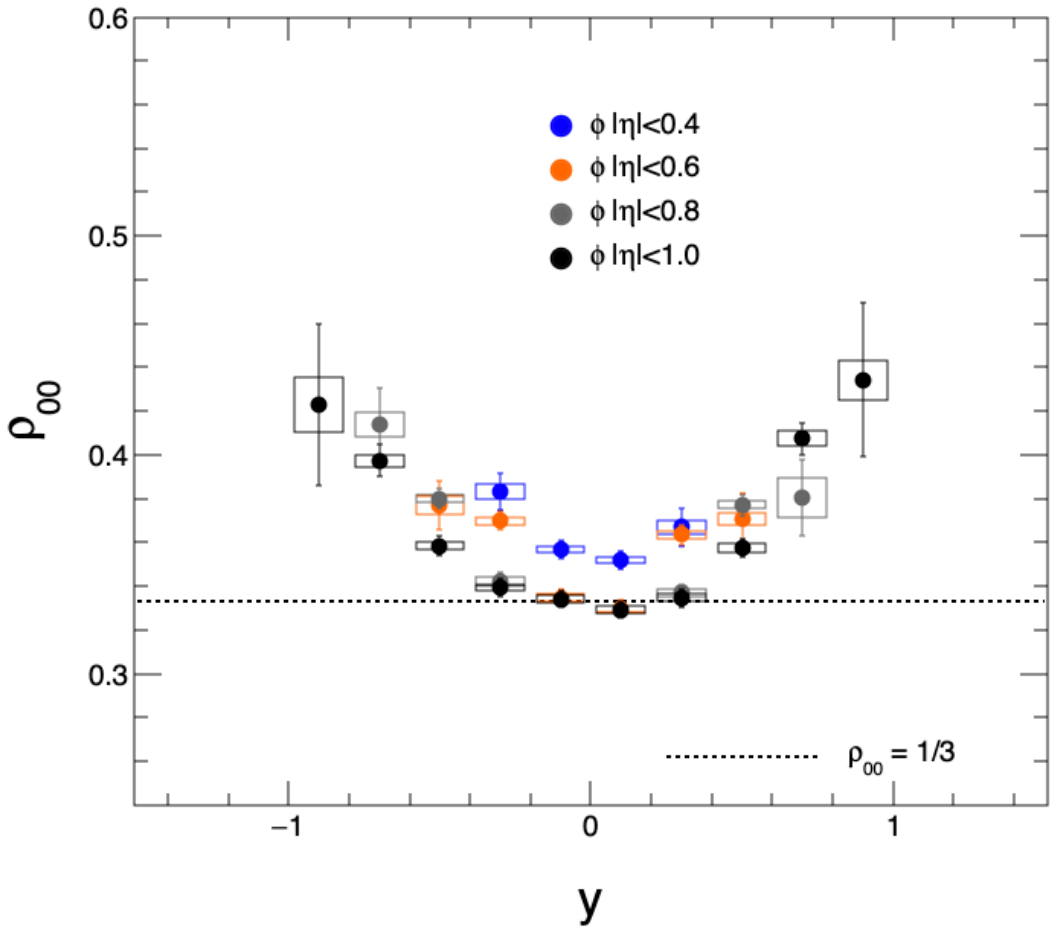

40-80%, $2.0 < p_T < 5.0$ GeV/c



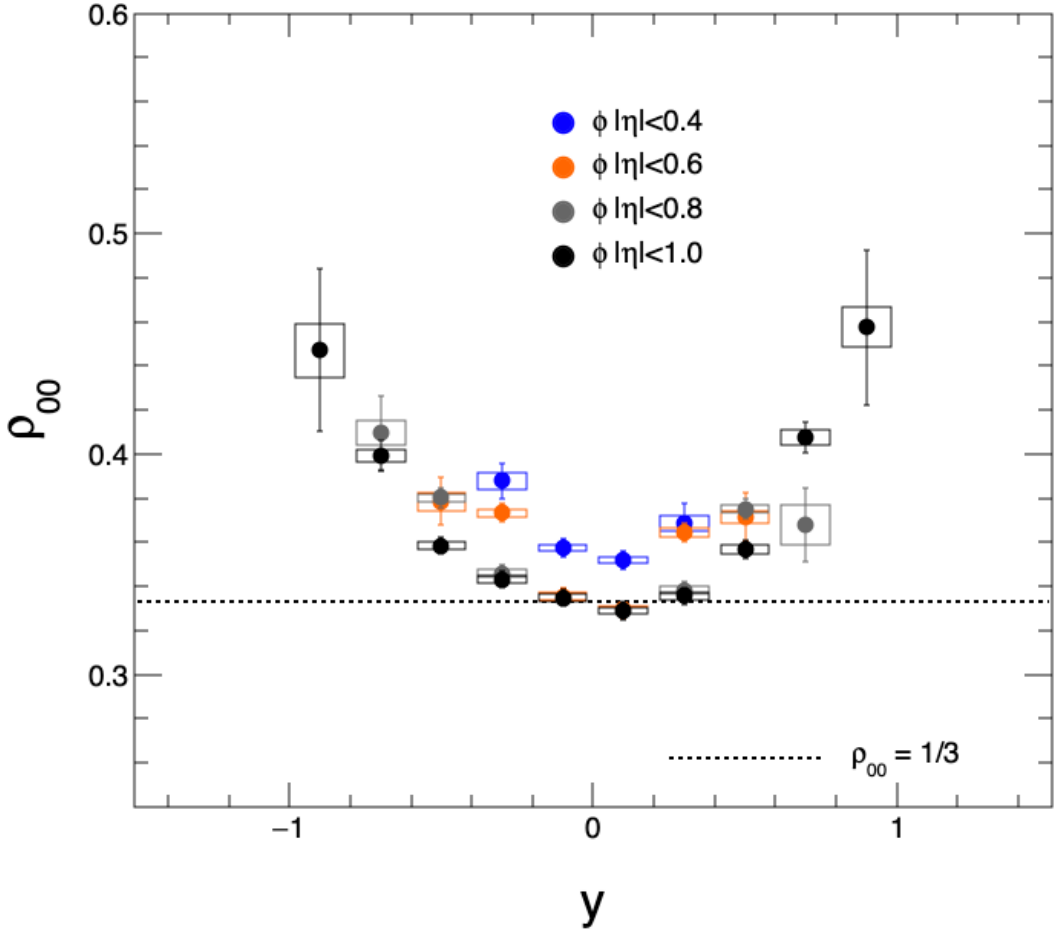

AuAu 19GeV 2019
0-80%
$v_2$
y
0.3
0.2
0.1
0
−1
0
1

# Rapidity dependent $\rho_{00}$

pT dependent v2



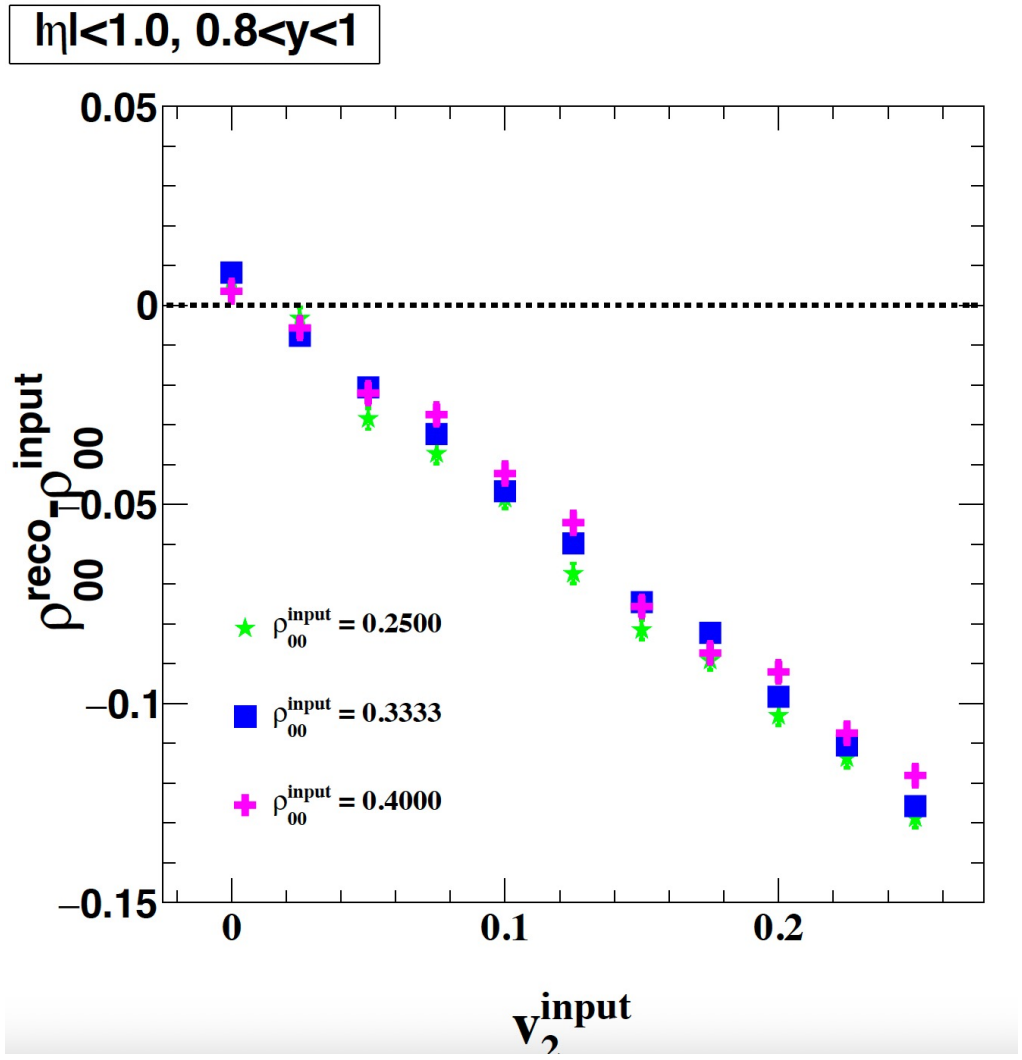

y dependent v2

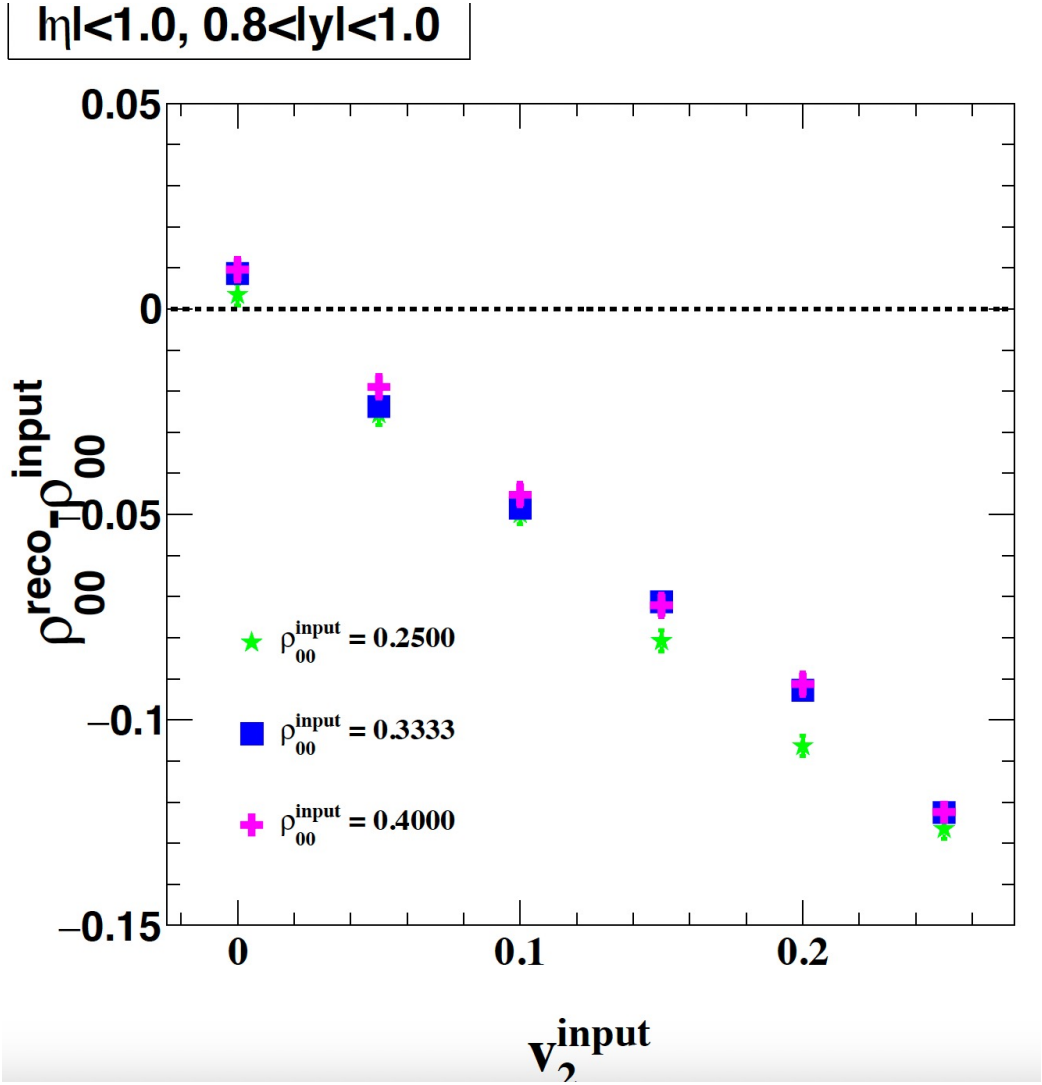



- Rapidity dependent $v_2$ is consistent with $p_T$ dependent $v_2$ results.

# 0.8 < |y| < 1.0 acceptance study

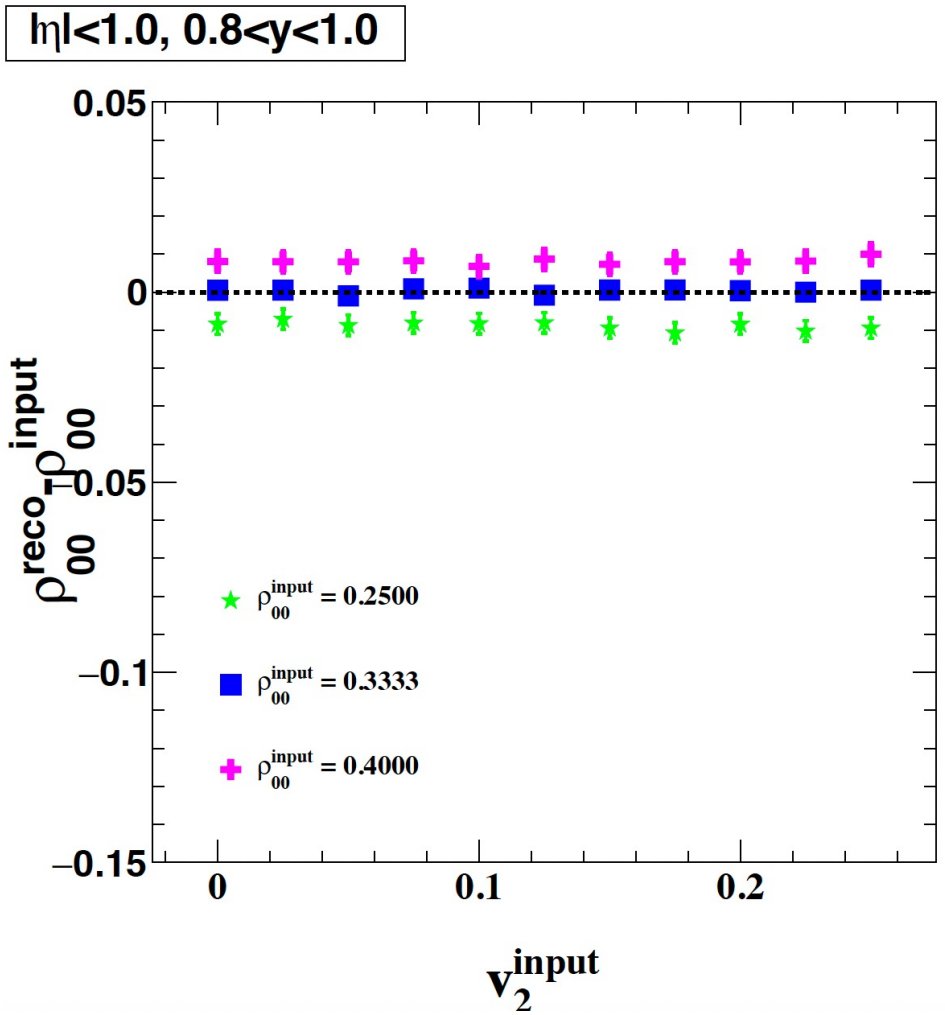
Use RP cosθ* distribution for deriving acceptance parameters.

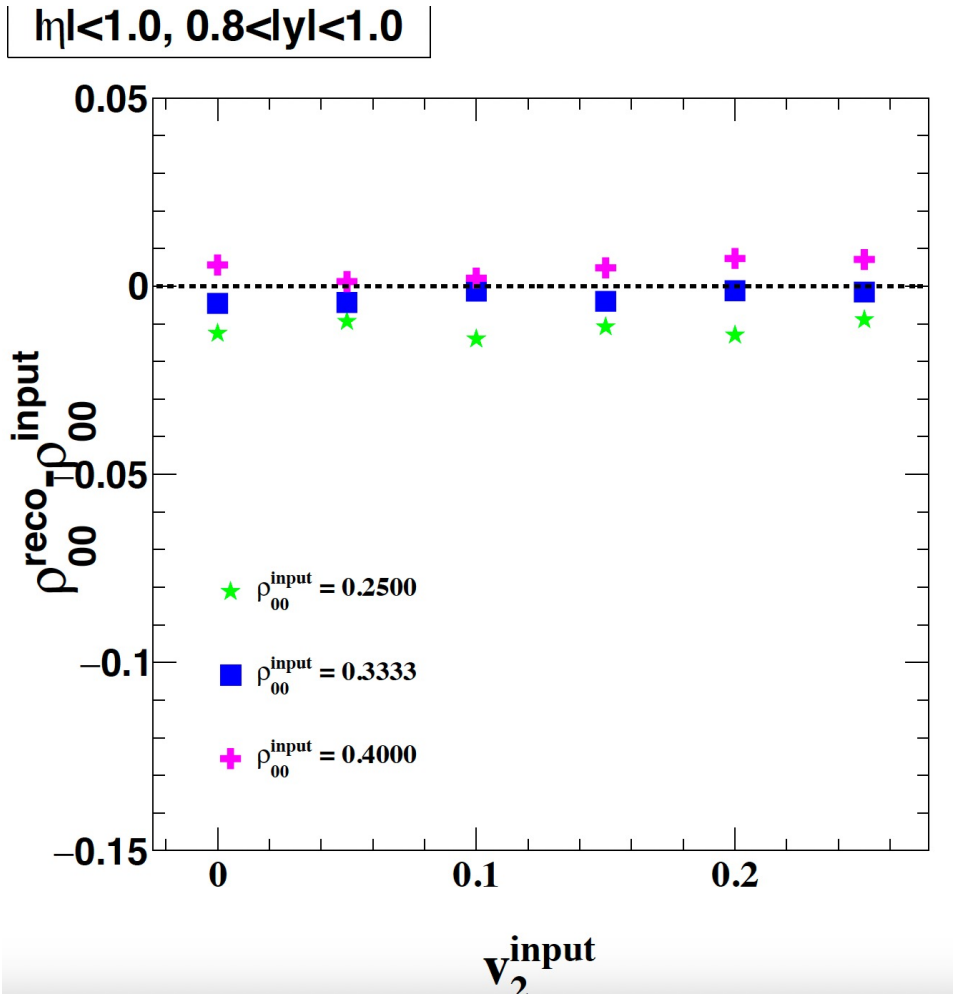


# 0.8 < |y| < 1.0 acceptance study

Use EP cosθ*' distribution for deriving acceptance parameters.

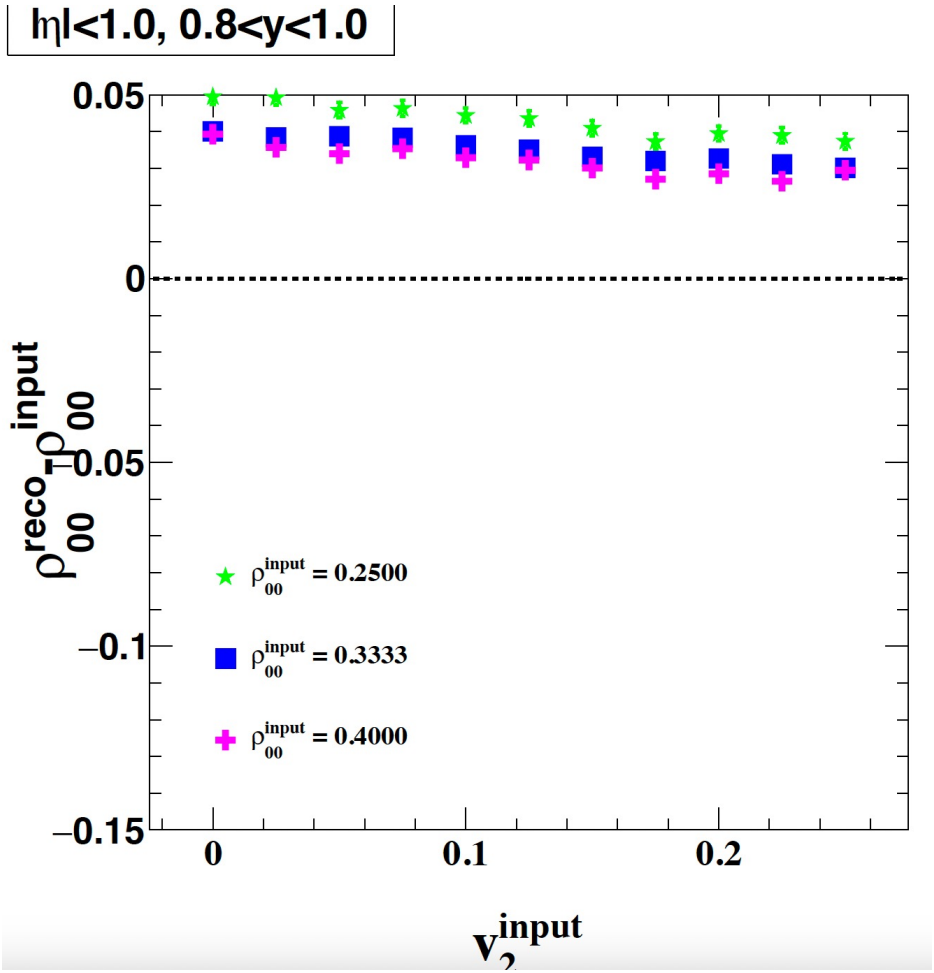


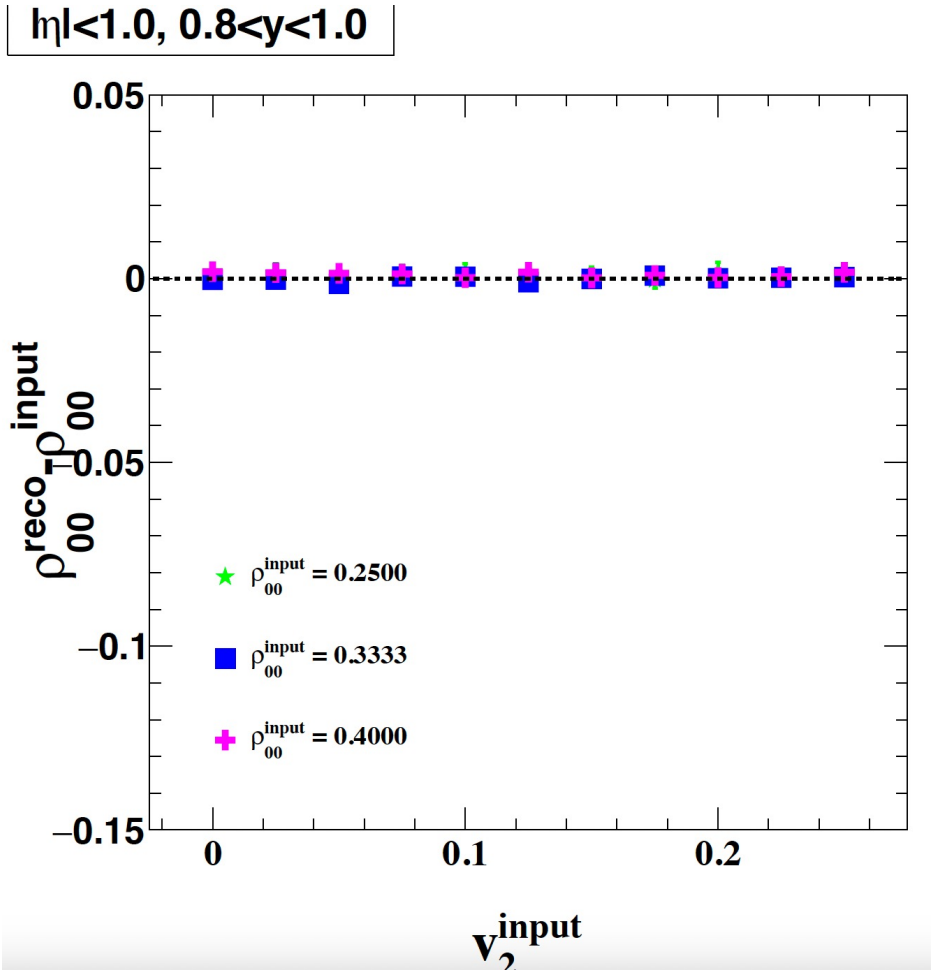

- Conclusion: Using absolute value of rapidity does not significantly change the results of this study.

# Using <cos2β> and <cos4β> in acceptance

Use values of <cos2β> and <cos4β> **after** |η| cut, per $\rho_{00}$ input



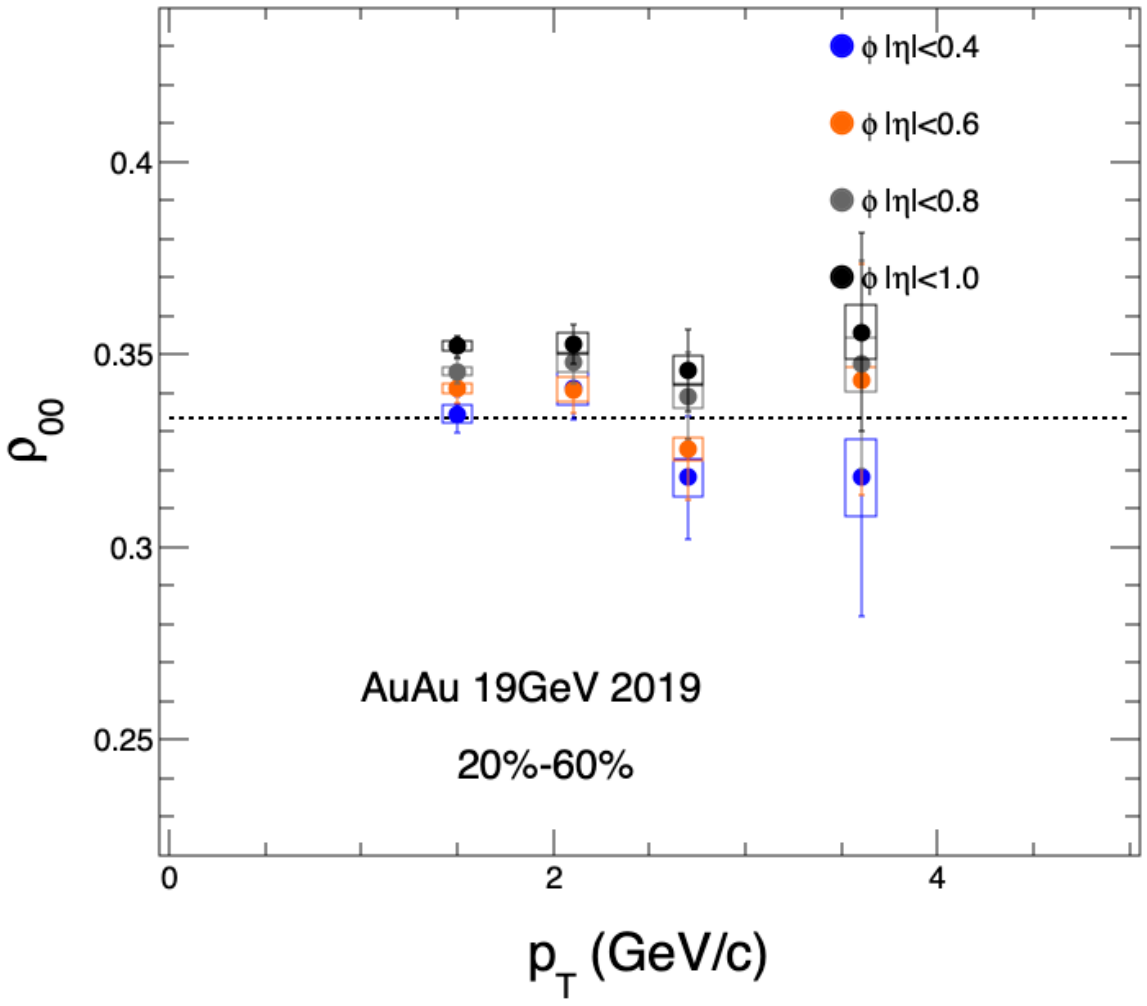

Use values of <cos2β> and <cos4β> **before** |η| cut, per $\rho_{00}$ input



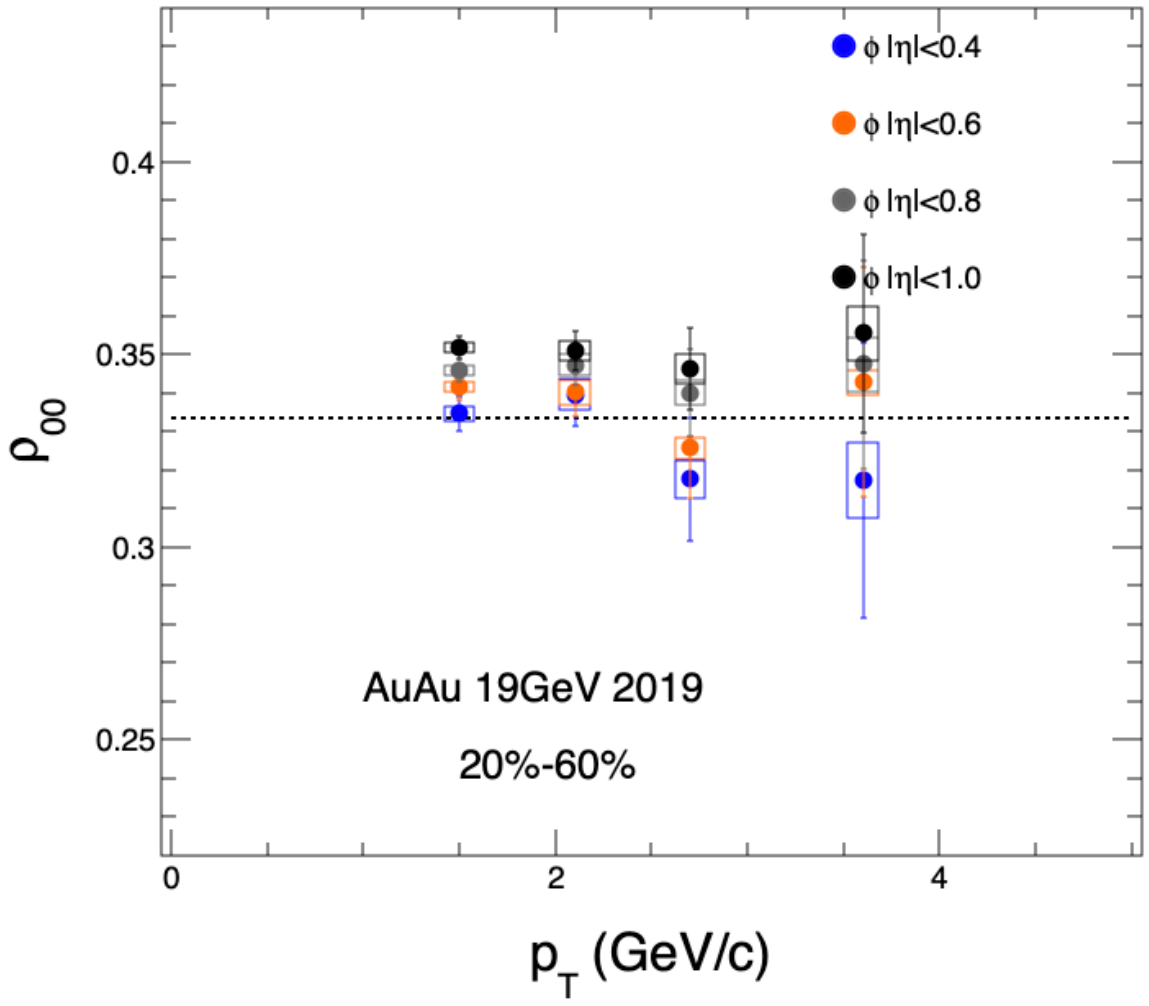

- Seems to work well if we use values **before** |η| cut, also works better than other method. <cos2β> is the only non-zero value in this case.

# Comparing correction methods for $p_T$ dependence

Eff Then Acc + EP Res

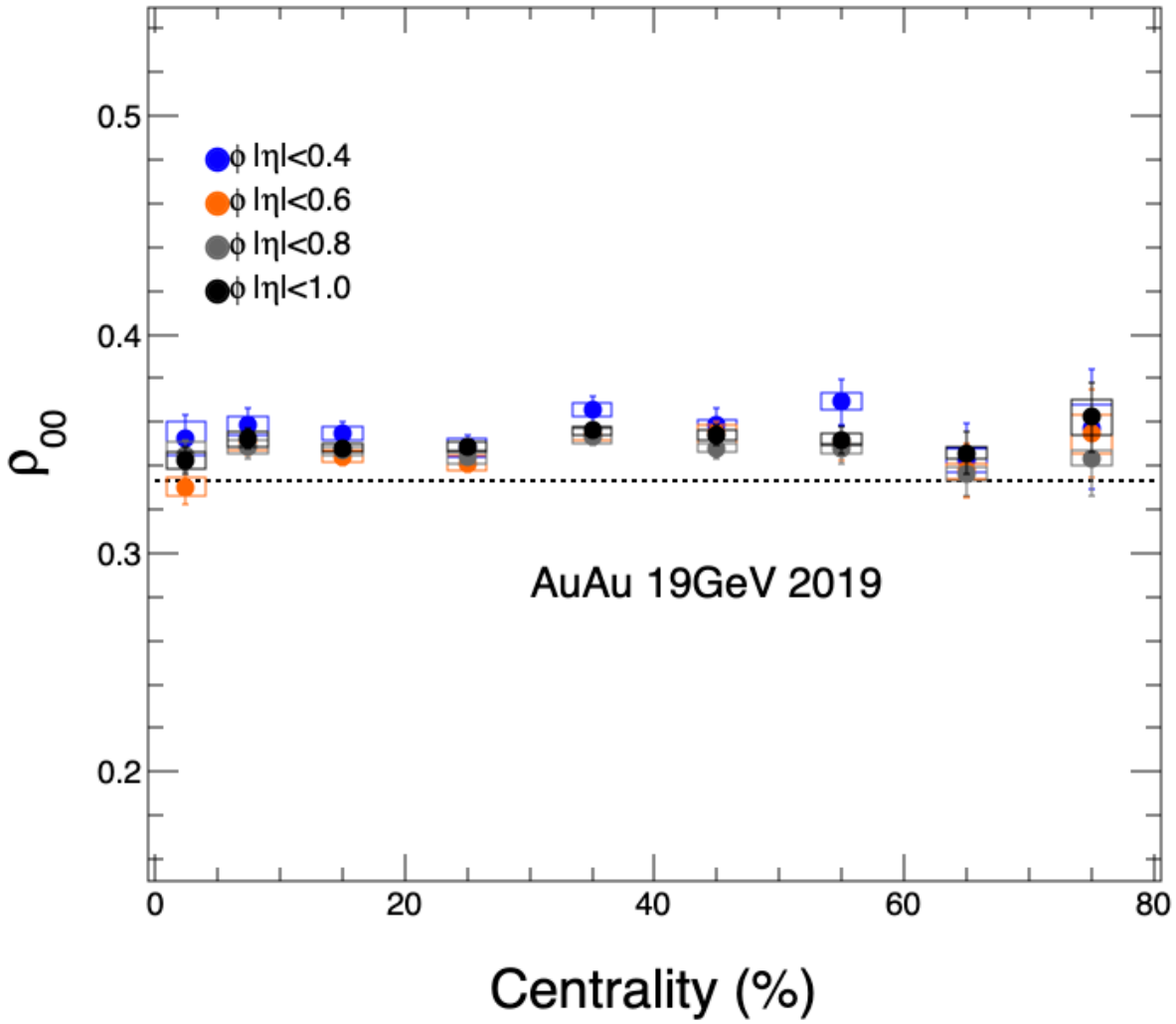



Eff+Acc Then EP Res




- Results appear consistent for different correction methods.
- Seems like an overcorrection.
- But if there was an increasing $\rho_{00}$ with increasing $|y|$, wouldn't this make sense?

# Centrality dependence




- This η cut dependence appears inverse to the dependence in the $p_T$ study.

# Road to QM2023

- URGENT: Solve acceptance correction dilemma.
  - Follow up on any points made during this meeting.
- This Weekend: Produce raw first order EP $\rho_{00}$ results for 19.6 GeV.
  - Perform same η cut study and compare to second order.
- Next week (07/17-07/21): Produce raw first order EP $\rho_{00}$ results for 14.6 GeV.
  - More time needed since I need to run the StEpdEventPlaneMaker several times.
- Other tasks:
  - 14.6 GeV $v_2$ vs $p_T$. Straight forward, code already in place.
  - 14.6 GeV $p_T$ spectra.