



**PWG review:**

**Measurements of Kaon Anti-flow in the High Baryon  
Density Region from Au + Au Collisions at  $\sqrt{s_{NN}} = 3 - 3.9$  GeV**

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# Suggestions

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- 1) Kaon v1: your negative kaon points especially at 3.5 GeV are kind of fluctuating bin by bin, they look a lot smoother in 3 GeV data. The systematic is also changing bin-by-bin. Since this paper is focussed on kaons, I wanted to understand more on this behavior of  $K^+$  and  $K^-$ . How do you understand the current behavior.
- 2) Proton v1: I am fine with it, please update all the latest version of figures.
- 3) v1 versus invariant mass for kshort: I would suggest to check the variation with background shape eg first/second order polynomial.
- 4) incompressibility: do you use  $K=210$  (soft EOS) for all the energies? If I remember in our prior 3 GeV paper, we used  $K=380$  (I believe hard EOS).  
I would suggest to mention  $K$  values used in JAM in the main manuscript.
- 5) Since you are aiming for a letter, you don't have space. So I suggested to include event plane resolution and v1 versus  $p_t$  figures as a supplemental materials to PRL.
- 6) around 196–197 of the draft, you should clarify that W/O spectator is the case where spectator interactions are turned off in JAM.

1) Kaon v1: your negative kaon points especially at 3.5 GeV are kind of fluctuating bin by bin, they look a lot smoother in 3 GeV data. The systematic is also changing bin-by-bin. Since this paper is focussed on kaons, I wanted to understand more on this behavior of  $K^+$  and  $K^-$ . How do you understand the current behavior.

The  $K^-$  v1 goes up in the for-rapidity, which is different with  $K^+$  and  $K^0$ .

It might be related with EM field, but the  $K^0$  is not in the middle...

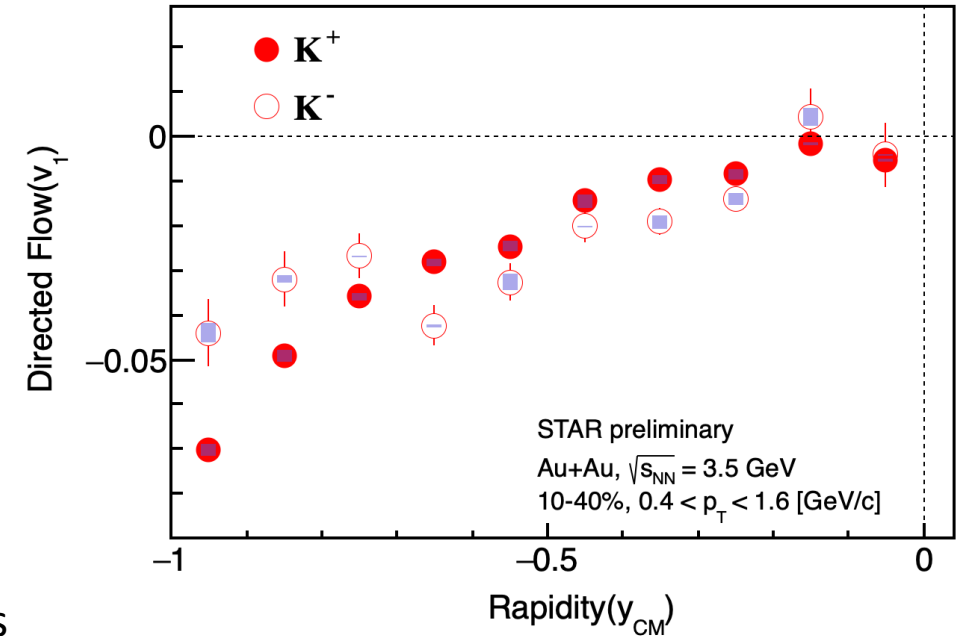
The following study focus on  $dv_1/dy$  in the mid-rapidity, the  $K^-$  behavior in the for-rapidity may not impact on the v1 slope extraction.

Anyway, it's a interesting behavior, we will follow it.

For the discontinuous you mentioned, I have re-calculated v1 and its sys. error with the most new dataset(P23ie), StRefMultCorr etc. The discontinuous still exists. I checked two possible reasons.

- 1) Purity. We got  $K^-$  purity which is separate from  $K^+$ , the nSigma shift I applied is unique for  $K^-$ . The purity might be OK...
- 2) Efficiency correction. There is discontinuous the efficiency correction is not applied though. Note: the embedding data is from 3.2 GeV, I am not sure if we use the specific embedding data for 3.5 GeV, the discontinuous would gone or not.

The v1 statistic error is large at  $p_T > 0.7$  GeV. the discontinuous might be explained by the statistic fluctuation. Sorry, I can't this questions for now.



2) Proton v1: I am fine with it, please update all the latest version of figures.

Sure, thank you.

3) v1 versus invariant mass for kshort: I would suggest to check the variation with background shape eg first/second order polynomial.

Poly2nd					Poly2nd		
y	K0s v1	v1 err			y	lam v1	v1 err
-0.9	-0.0660992	0.00587223			-0.9	-0.245313	0.00207474
-0.7	-0.0430644	0.00366149			-0.7	-0.160383	0.00150039
-0.5	-0.0251633	0.00298053			-0.5	-0.0979796	0.00126827
-0.3	-0.0102379	0.00297726			-0.3	-0.0568806	0.00135654
-0.1	-0.00605152	0.00332894			-0.1	-0.0253145	0.0017294
Poly3rd					Poly3rd		
y	K0s v1	v1 err			y	lam v1	v1 err
-0.9	-0.066087	0.00587677			-0.9	-0.245251	0.00207484
-0.7	-0.0430798	0.00366529			-0.7	-0.160359	0.00150049
-0.5	-0.0251502	0.00298332			-0.5	-0.0979525	0.00126834
-0.3	-0.0102496	0.00297976			-0.3	-0.0568453	0.00135663
-0.1	-0.00602678	0.00333784			-0.1	-0.0241242	0.00172953

I tested the different  $v1^{BG}$  function, as you can see in the table. The v1 difference is about 0.0001. It would be covered by other sys. sources.

4) incompressibility: do you use  $K=210$  (soft EOS) for all the energies?  
If I remember in our prior 3 GeV paper, we used  $K=380$  (I believe hard EOS).  
I would suggest to mention  $K$  values used in JAM in the main manuscript.

Yes, for all energies.

You are right,  $K=380$  in 3 GeV paper, and the JAM mode is named as RQMD/RMF.

In this work, the momentum dependence potential is taken into account, the JAM mode is RQMDv/MS2.

which can describe  $v_1$  better than the one used in 3 GeV paper.

Modified the draft as:

For protons, cascade mode (blue dash line) underestimates  $v_1$  of protons, and mean-field mode (blue solid line) involved repulsive baryon interactions where the nucleon incompressibility  $\kappa$  is 210 MeV, have a good agreement with the experimental data.

5) Since you are aiming for a letter, you don't have space. So I suggested to include event plane resolution and v1 versus pt figures as a supplemental materials to PRL.

Will do that, thank you.

6) around 196–197 of the draft, you should clarify that W/O spectator is the case where spectator interactions are turned off in JAM.

Updated it as follows:

Additionally, the JAM cascade without spectator (red dash band) where the spectator interactions are turned off, exhibits a larger  $v_1$  slope compared to the one with spectators.



# Backup