

# Directed flow of identified particles in Au+Au collisions at $\sqrt{s_{NN}} = 19.6$ and 14.6 GeV

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1 Determination of equation of state for nuclear matter at high baryon density  
2 region is one of the most important motivations for RHIC Beam Energy Scan  
3 program. Directed flow ( $v_1$ ), which is the first harmonic coefficient in the Fourier  
4 expansion of the final state azimuthal distribution of produced particles relative  
5 to the collision reaction plane, is one of good probes to early stage of collision  
6 dynamics for its high sensitivity.

7 STAR Beam Energy Scan program phase I (BES I) covers collision energies  
8 from  $\sqrt{s_{NN}} = 7.7$  GeV to 200 GeV. We observed that  $v_1$  slopes ( $dv_1/dy|_{y=0}$ )  
9 at mid-rapidity region for net-proton and net- $\Lambda$  show a minimum value when  
10 collision energy is around  $\sqrt{s_{NN}} = 10$ -20 GeV [1]. The slope of  $\phi$  mesons has a  
11 hint of sign change between 11.5 and 14.5 GeV [2]. With large statistics from  
12 BES II, we will present  $v_1$  results of pions, kaons, protons, and  $\phi$  mesons. The  
13 corresponding  $v_1$  slopes will be studied as a function of centrality. The data  
14 will constrain the model calculations and offer information about possible first  
15 order QCD phase transition.

## 16 References

- 17 [1] L. Adamczyk et al.(STAR Collaboration), Phys. Rev. Lett. 112, 162301  
18 (2014).
- 19 [2] L. Adamczyk et al.(STAR Collaboration), Phys. Rev. Lett. 120, 062301  
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