THE OHIO STATE UNIVERSITY DEPARTMENT OF PHYSICS

Viscous Elliptic and Triangular flows at LHC

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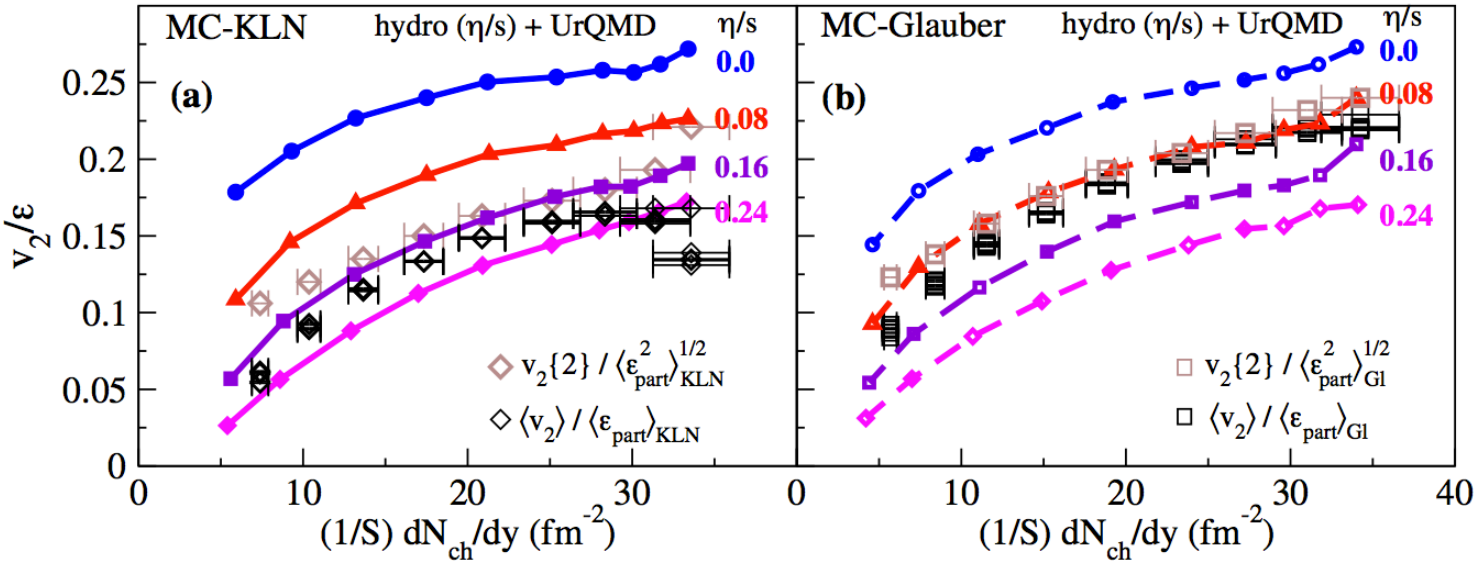
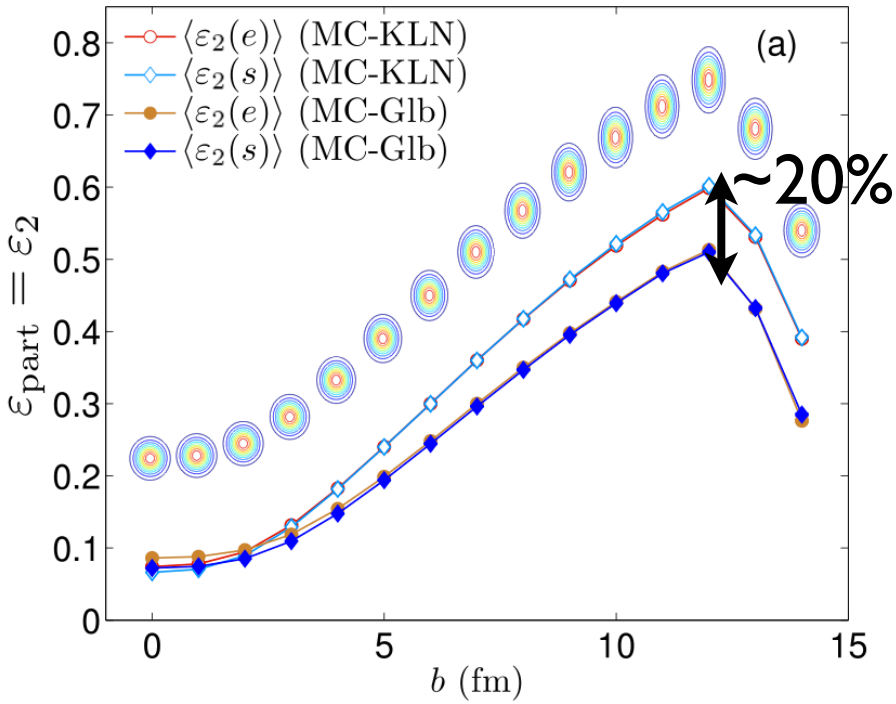
Introduction



Song et al.
PRL106 (2011)192301



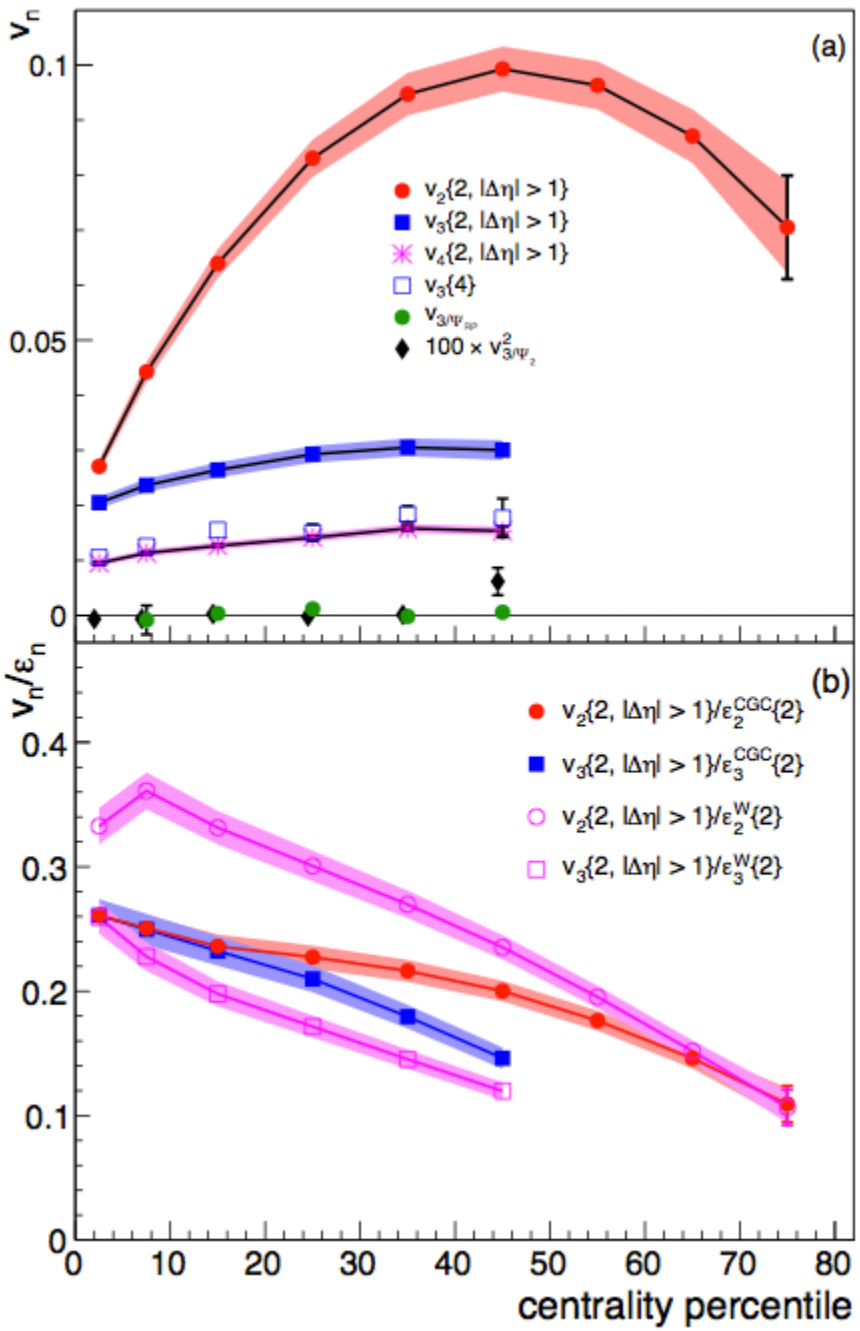
Qiu and Heinz, Phys.Rev. C84 (2011) 024911

$$1 < 4\pi(\eta/s)_{\mathrm{QGP}} < 2.5$$

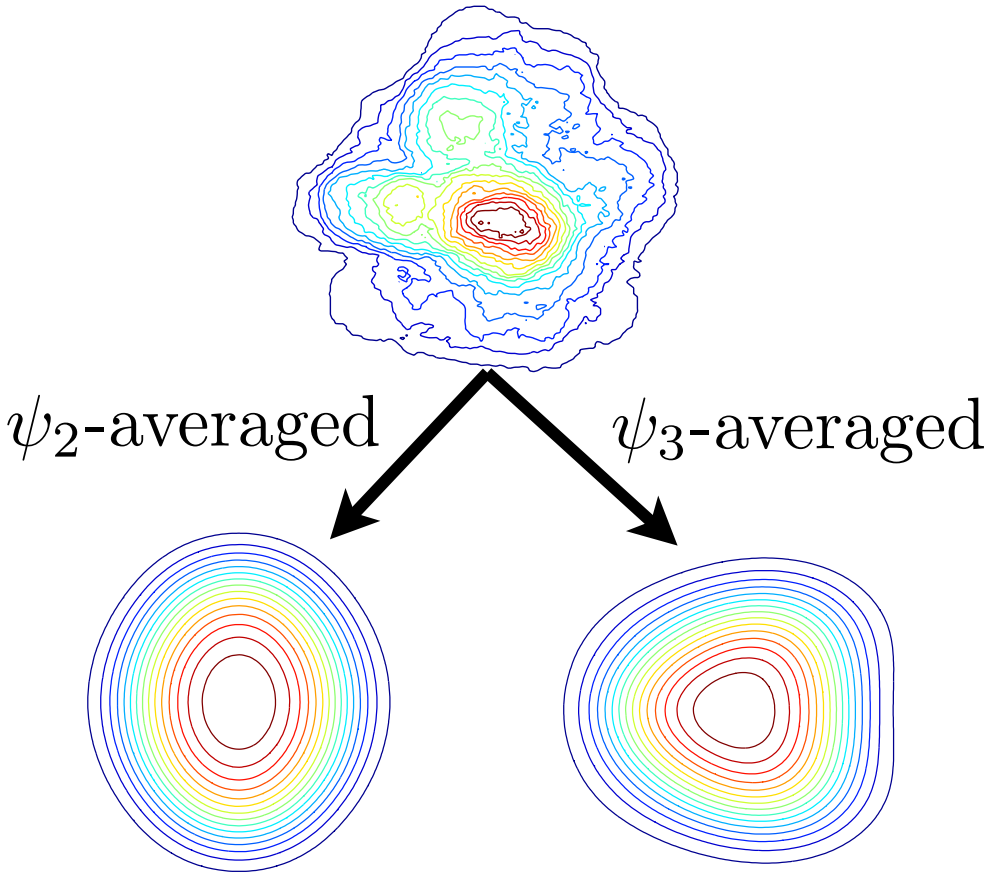
- $v_2^{\mathrm{ch}}/\epsilon_x$ vs. $(1/S)dN_{\mathrm{ch}}/dy$ is universal
  It only depends on η/s

- The remaining dominant source of uncertainty: $\epsilon_x^{\mathrm{Glb}}$ vs. $\epsilon_x^{\mathrm{KLN}}$

ALICE Collaboration,
Phys.Rev.Lett. 107:032301,2011



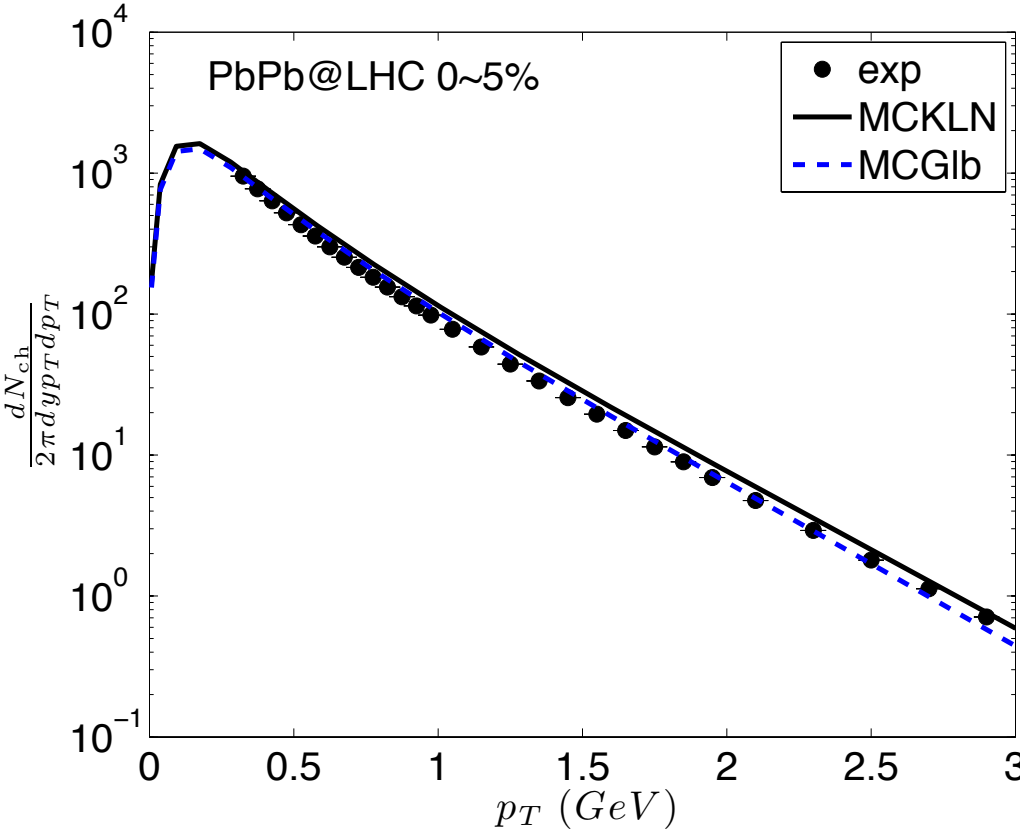
E-by-e hydro is more realistic;
but expensive calculations (e.g. reso. decay)
are only practical for single-shot hydro

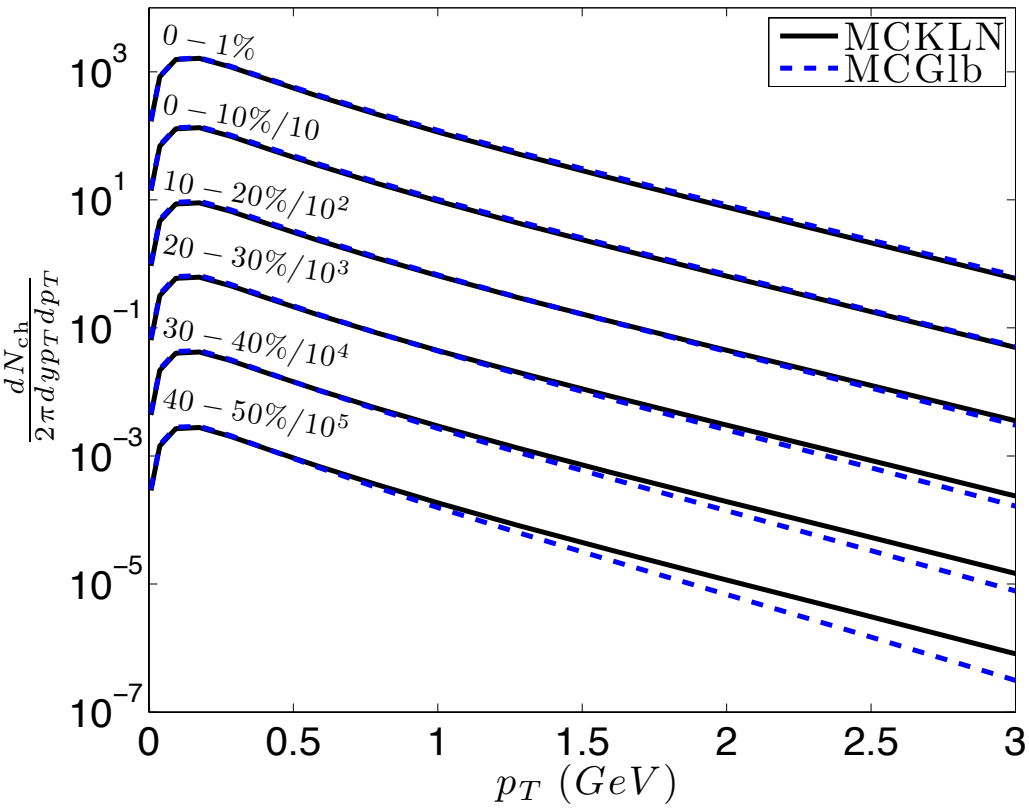


Use single-shot hydro to substitute for
e-by-e hydro;
they give similar v_2/ε_2 and v_3/ε_3

(See Zhi Qiu's talk)

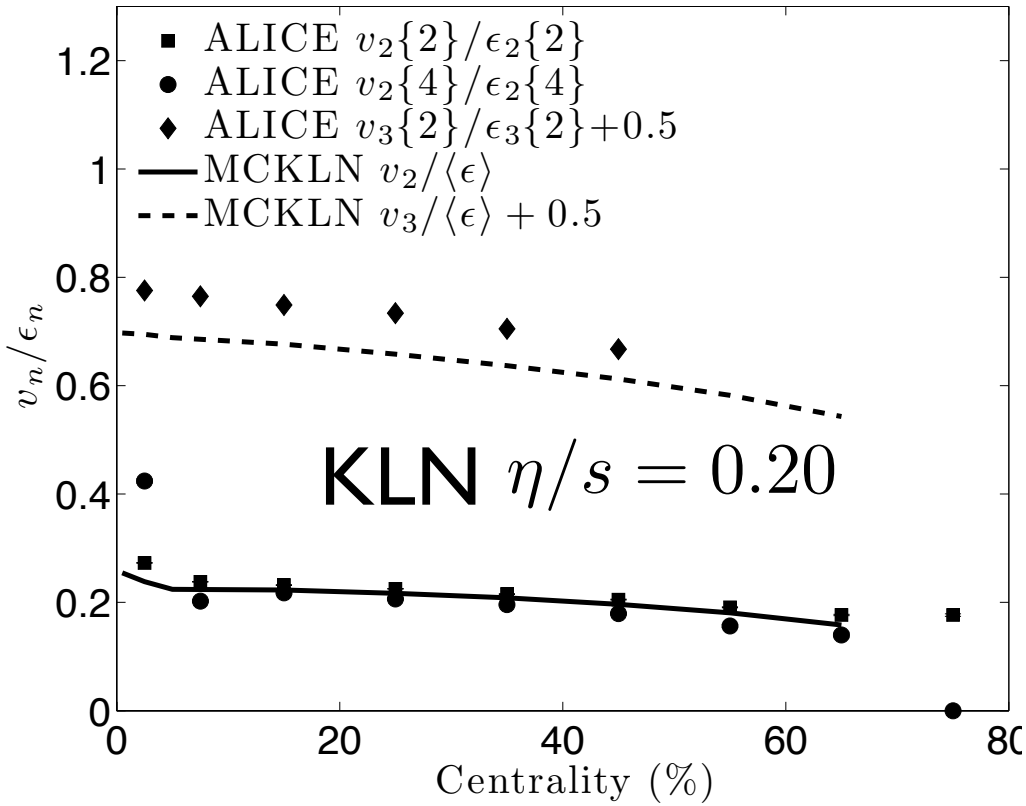
Particle Spectra

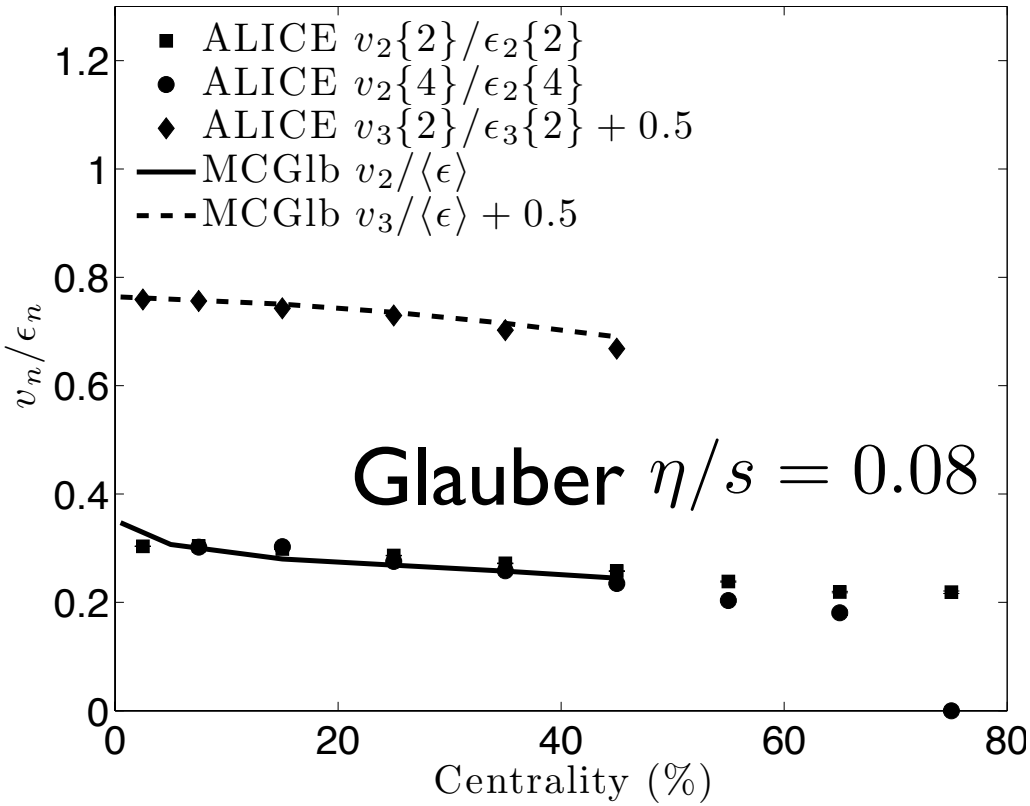




- In central collisions, both models give good descriptions of the p_T-spectra of all charged particles
- The centrality dependence of the p_T-spectra can help us to distinguish between the two initial models

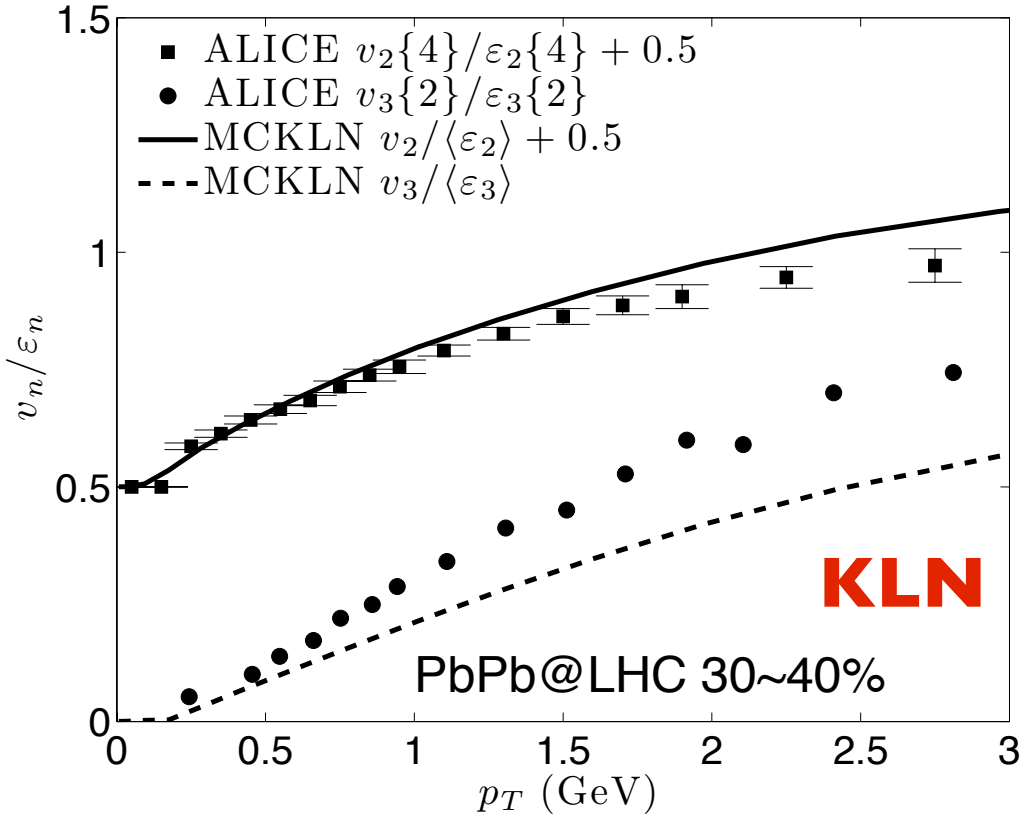
Elliptic and Triangular Flow

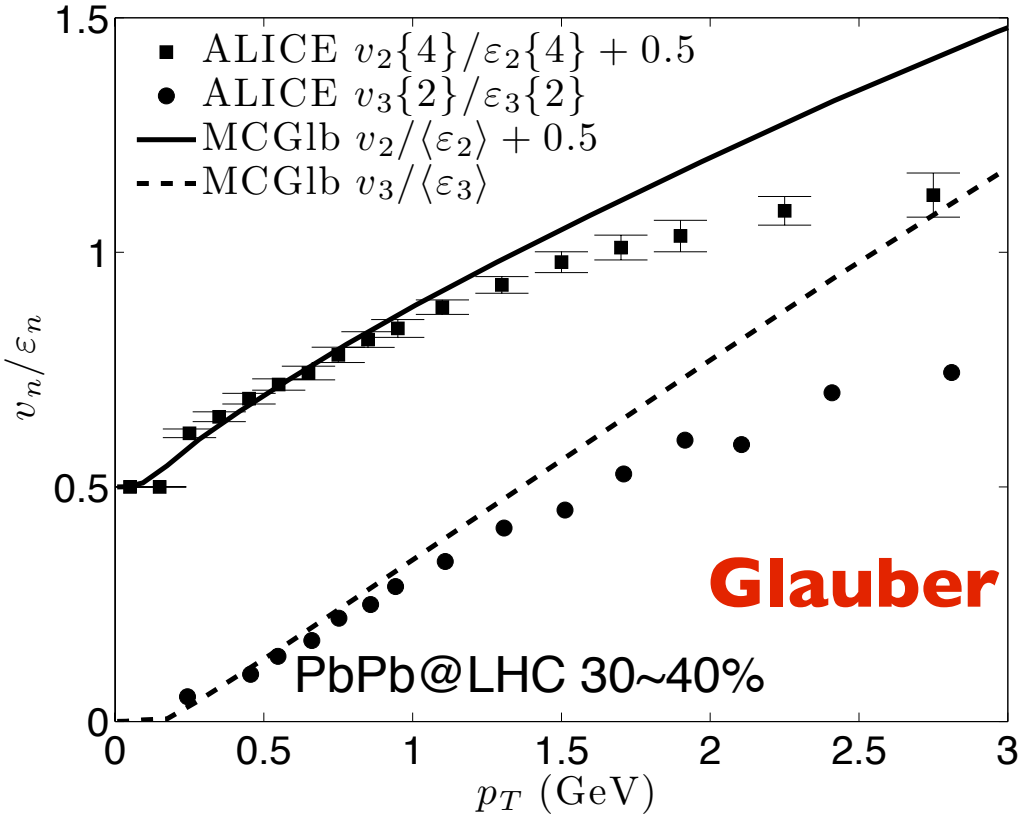




- By tuning η/s, both models can describe elliptic flow of all charged hadrons at LHC energy
- **MCKLN** underestimates v_3/ϵ_3 by 20%, while **MCGlb** gives fairly good agreement with ALICE data

Differential $v_n(p_T)$





Magnitude of p_T-integrated v_3 is better described by **MC-Glb.**; shape of $v_{2/3}(p_T)$ is better described by **MC-KLN**

- Indicates the slope of p_T-spectra of **MC-Glb.** is too steep in large centralities
- Can this be improved by e-by-e hydro and/or VISHNU?

Summary

- ALICE v_n data favor MC-Glauber with $\eta/s \sim \frac{1}{4\pi}$

- Need further confirmation from more realistic calculations, e.g. VISHNU or e-by-e hydro.