

Measurement of Direct Photon Higher Order Azimuthal Anisotropy in $\sqrt{s_{NN}} = 200\text{GeV}$ Au+Au Collisions at RHIC-PHENIX

Sanshiro Mizuno (University of Tsukuba)
sanshiro@bnl.gov



Introduction

Direct photon: all photons except those coming from hadron decays.

They are powerful tools to study the QGP.

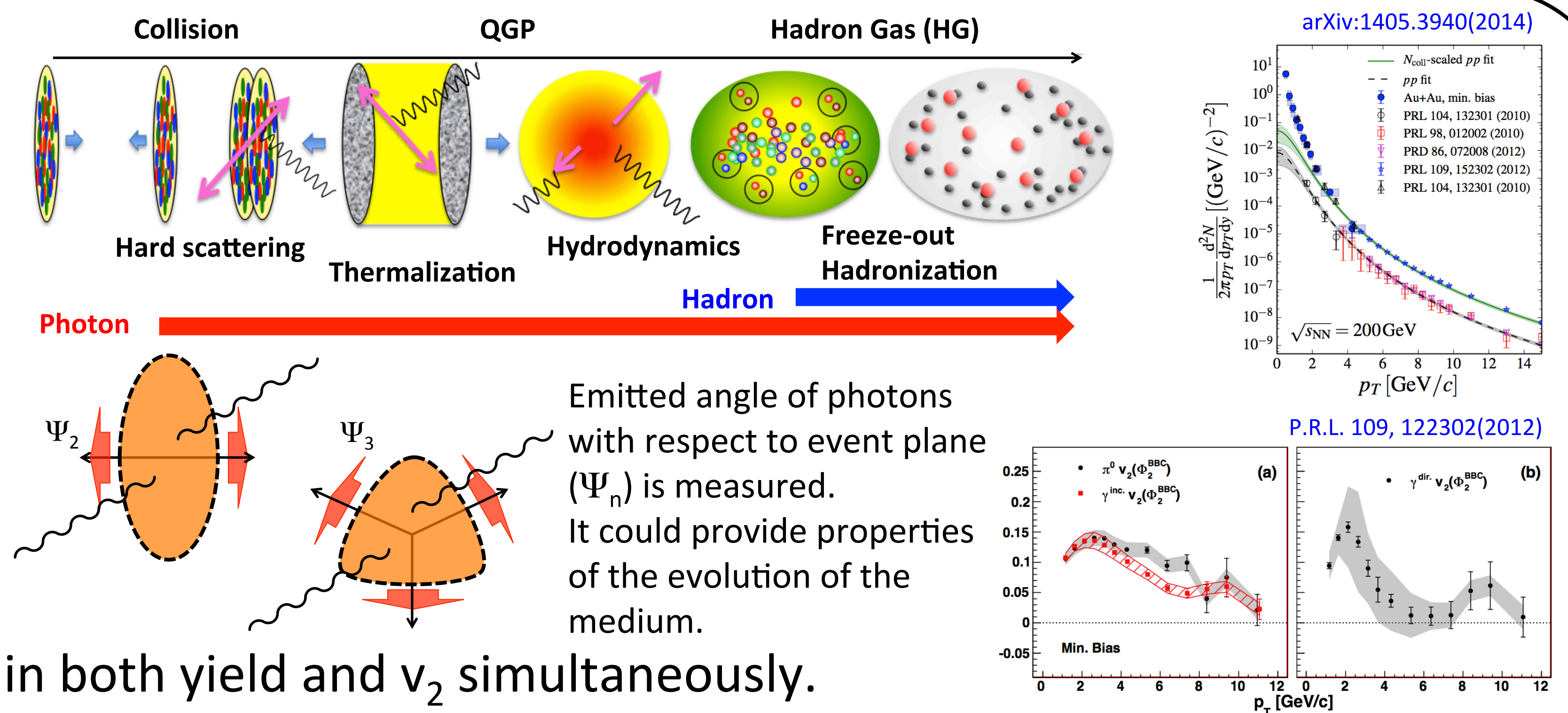
- ✓ Do not strongly interact with the medium
- ✓ Created during all stages

Direct photon p_T spectra and v_2 have been measured.

- Large excess of photon yield in Au+Au
- High effective temperature (240 MeV)
- Large v_2 comparable with hadron v_2

Significant theoretical efforts are begin made to explain both yield and v_2 simultaneously.

Direct photon v_3 originating from the initial geometry fluctuation may help disentangling different sources of photons.



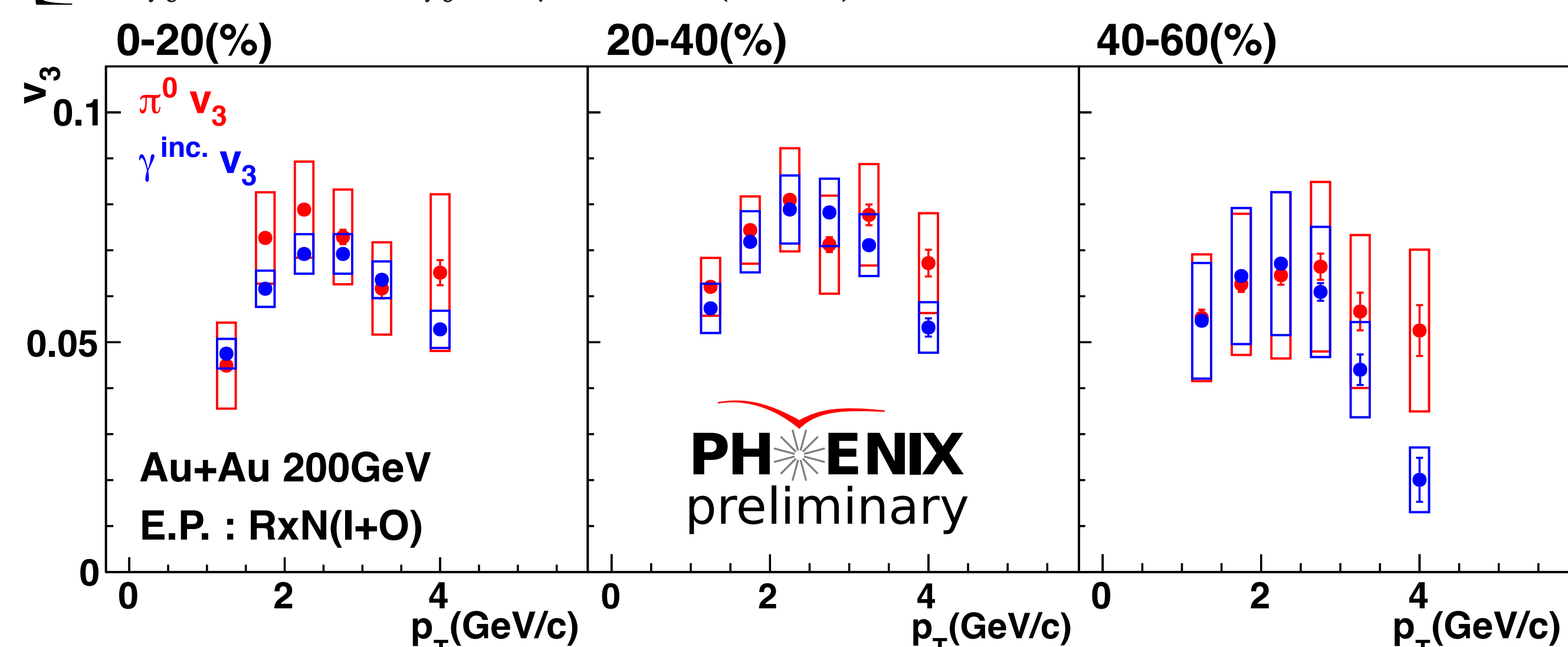
Analysis Flow

Photons and neutral pions are reconstructed by Electromagnetic calorimeter ($|\eta| < 0.35$).

Event Plane (Ψ_n) is defined by Reaction Plane detector (RxN) ($1 < |\eta| < 2.8$).

$$v_n = \langle \cos \{n(\phi - \Psi_n)\} \rangle$$

$$v_n^{true} = v_n^{obs.} / \text{Res}(\Psi_n)$$



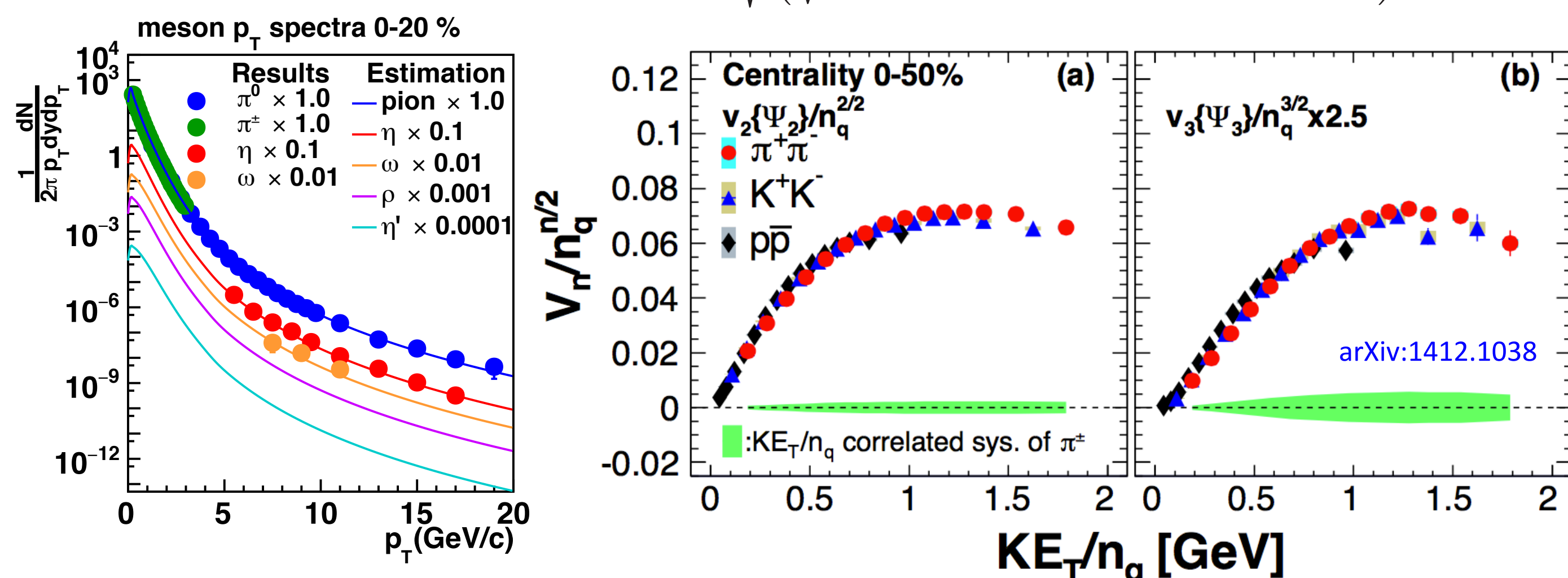
Decay photon v_n is simulated from mesons such as η , ω , ρ , η' which are estimated from pion.

- p_T spectra : m_T scaling

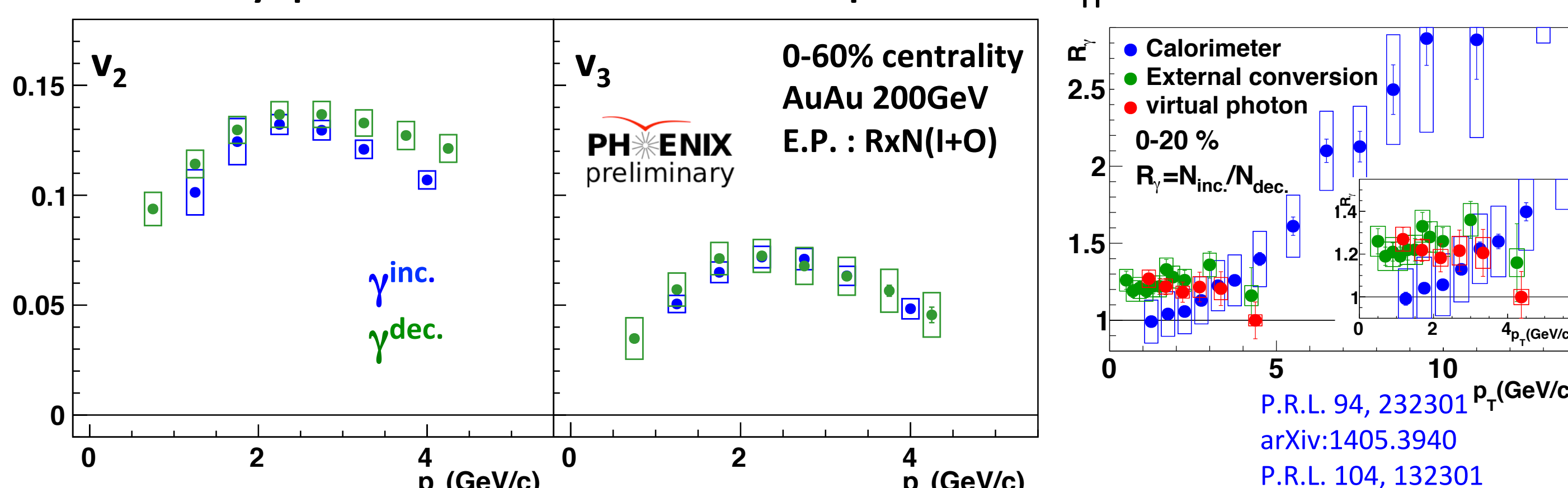
$$p_{T,meson} = \sqrt{p_{T,pion}^2 + M_{meson}^2 - M_{pion}^2}$$

- v_n : the number of constituent quark scaling (NCQ)

$$p_{T,meson} = \sqrt{(\sqrt{p_{T,pion}^2 + M_{pion}^2} - M_{pion} + M_{meson})^2 - M_{meson}^2}$$



- ✓ Decay photon and inclusive photon v_n

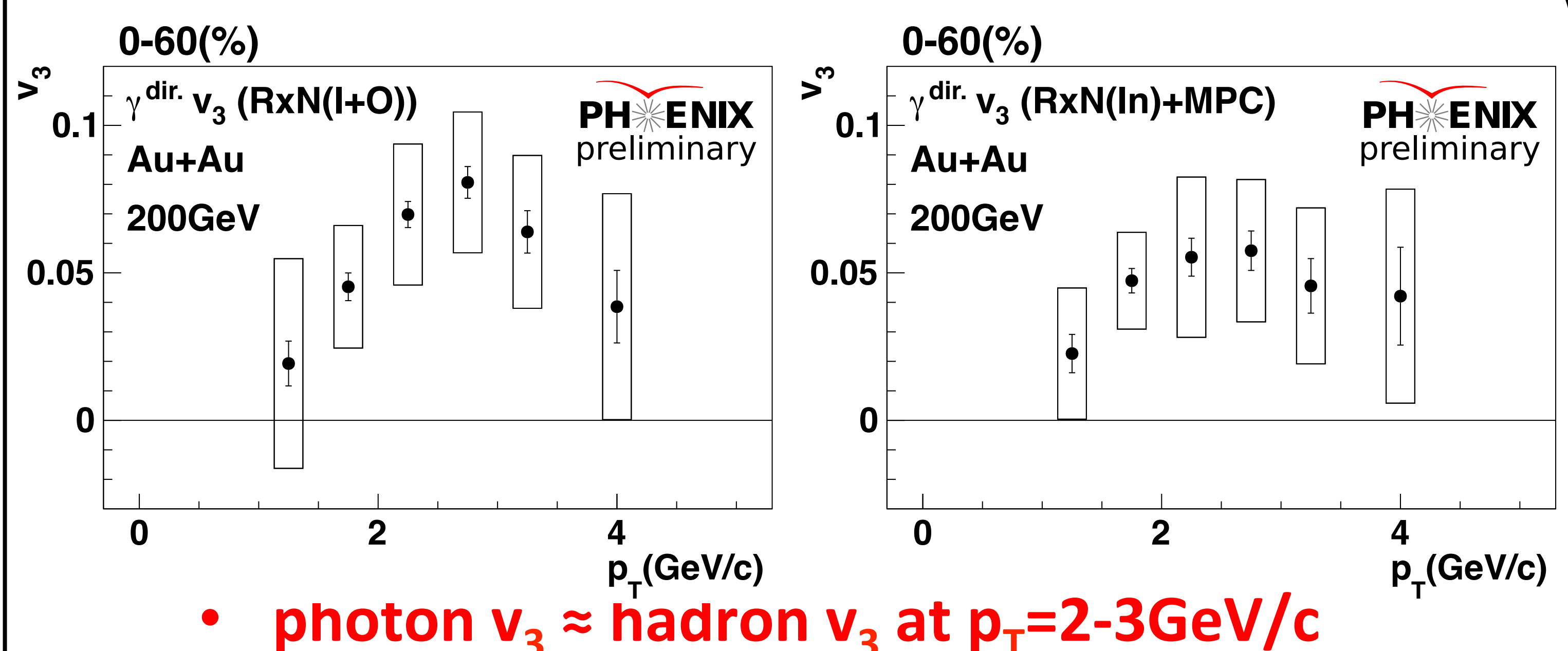


Direct photon v_n is extracted.

$$v_n^{dir.} = \frac{R_\gamma v_n^{inc.} - v_n^{dec.}}{R_\gamma - 1}$$

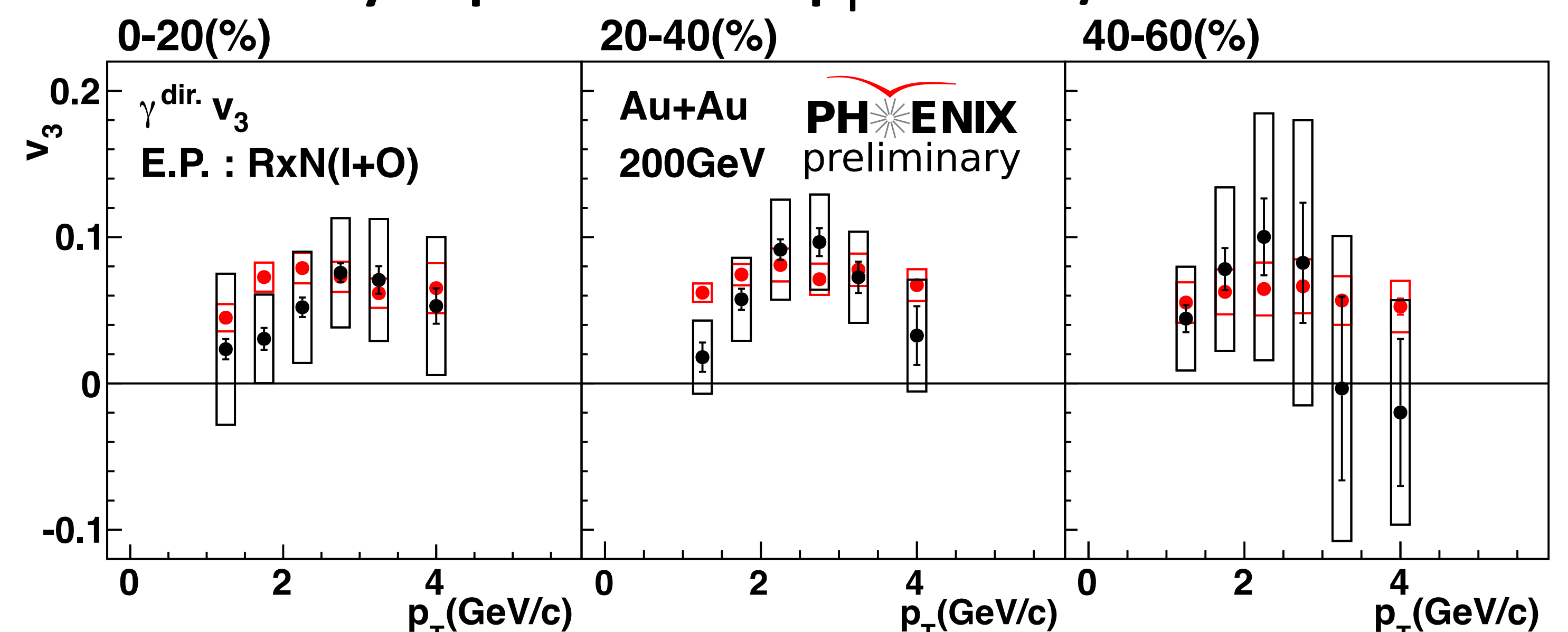
R_γ : Photon excess over known BG photons

Results



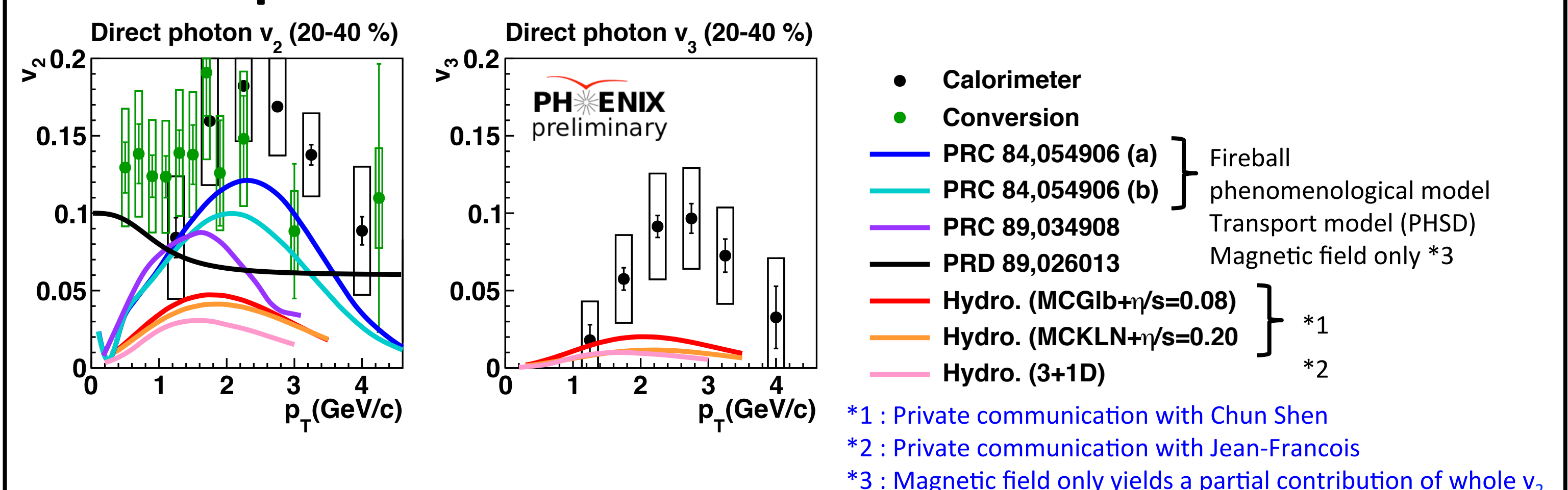
- **photon $v_3 \approx$ hadron v_3 at $p_T = 2-3\text{GeV/c}$**

- ✓ Centrality dependence at $p_T < 6\text{ GeV/c}$



- **Centrality dependence is similar.**
- **Photon v_n could be developed both at initial stage and expansion of medium (like hadron v_n).**

- ✓ Comparison with model calculations



- **The models including photons from late stage relatively describe experimental measurement.**

Conclusion

- Positive and non-zero photon v_3 is measured in low p_T .
- Centrality dependence of photon v_n is similar to that of hadron v_n at $p_T = 2-3\text{ GeV/c}$.
- Photon v_n could be described by the models that take photons from late stage into account.