Systematic studies of the centrality-dependence of soft photon production in Au+Au collisions with PHENIX

Benjamin Bannier for the PHENIX collaboration

Department of Physics, Stony Brook University

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Soft photons $0.4\,\text{GeV}/c < p_T < 5.0\,\text{GeV}/c$

Probe (our understanding of)
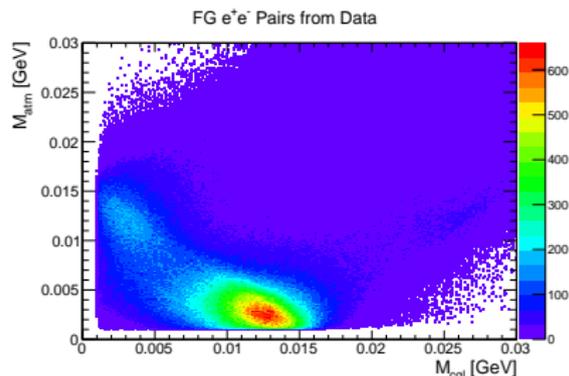the full space-time evolution

- initial (hard) scattering
- approach to equilibrium
- QGP evolution
- interactions in HRG

- soft photons difficult to
  measure in an EMCal
- use conversions of real
  photons $\gamma \to ee$

$$R_\gamma = \frac{Y_{\text{incl}}/Y_{\pi^0}}{Y_{\text{decay}}/Y_{\pi^0}} = \frac{\langle \varepsilon f \rangle N_{\text{incl}}^\gamma / N_{\pi^0}^\gamma}{Y_{\text{decay}}/Y_{\pi^0}}$$

FG e$^+$e$^-$ Pairs from Data

$$N_{\text{incl}}^\gamma(p_{T_\gamma}) = Y_{\text{incl}}\, a_{ee}\, \varepsilon_{ee}\, p_{\text{conv}}$$
$$N_{\pi^0}^\gamma(p_{T_\gamma}) = Y_{\pi^0}\, a_{ee}\, \varepsilon_{ee}\, p_{\text{conv}} \langle \varepsilon f \rangle$$

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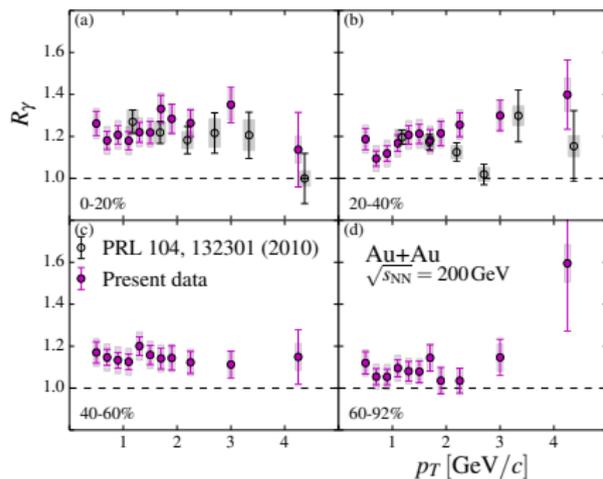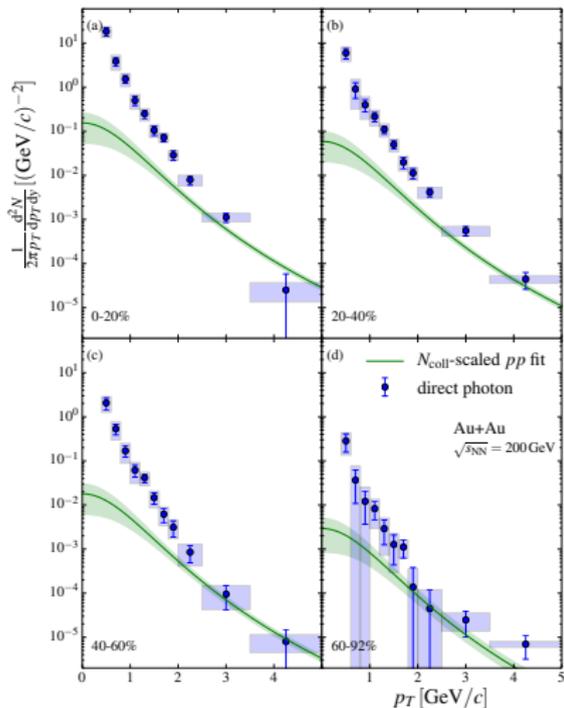- initial (hard) scattering
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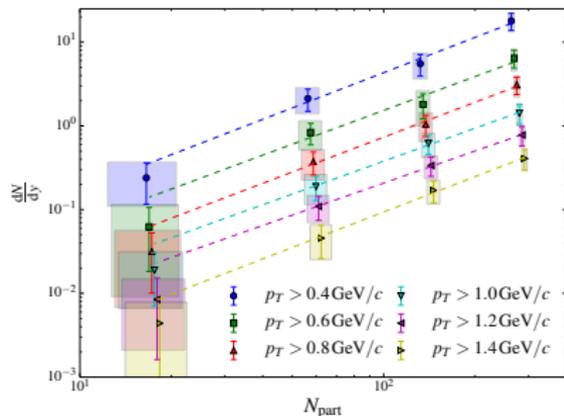- use conversions of real photons $\gamma \to ee$

$$Y_{\text{direct}} = (R_\gamma - 1) Y_{\text{decay}}$$

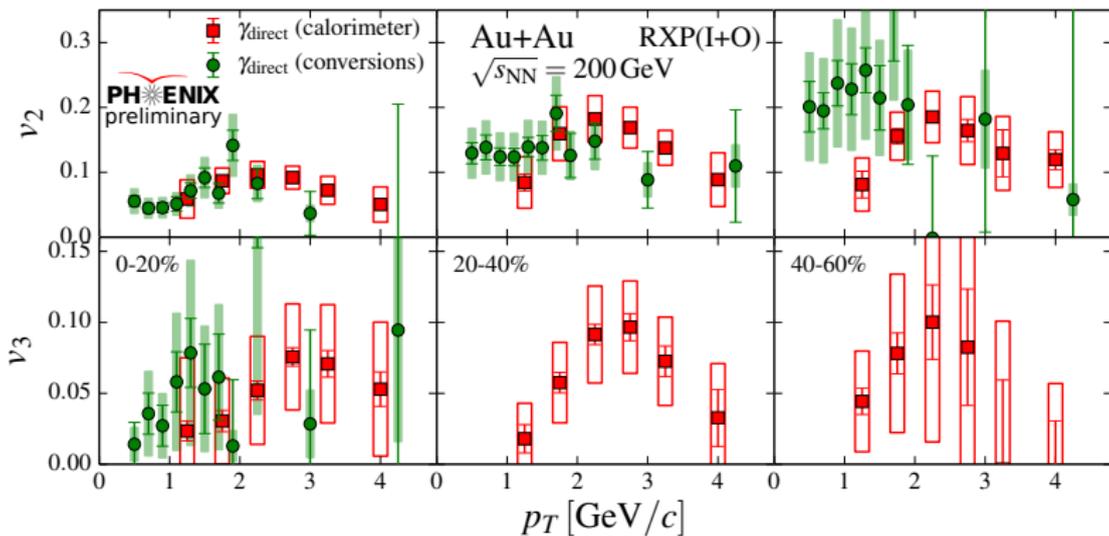| centrality	inverse slope
0-20%	$(239 \pm 25 \pm 7)\,\text{MeV}/c$
20-40%	$(260 \pm 33 \pm 8)\,\text{MeV}/c$
40-60%	$(225 \pm 28 \pm 6)\,\text{MeV}/c$
60-92%	$(238 \pm 50 \pm 6)\,\text{MeV}/c$

Excess photon yield grows
$\propto N_{\text{part}}^{1.48 \pm 0.08(\text{stat}) \pm 0.04(\text{syst})}$.

$$v_n^{\text{direct}} = \frac{R_\gamma\, v_n^{\text{inclusive}} - v_n^{\text{decay}}}{R_\gamma - 1}$$

v_n: weighted average of different sources

- v_2 deep into the "thermal" component of the direct photon signal with pure sample
- low p_T behavior?

arXiv:1405.3940 [nucl-ex]