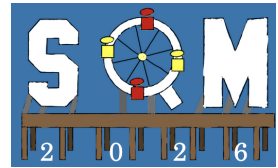


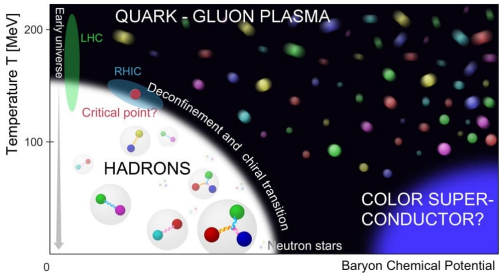
Overview of Recent PHENIX Results on Strangeness and Heavy Flavor

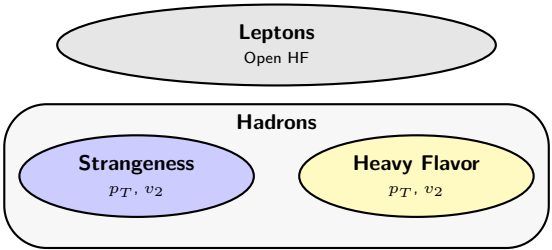
Yuri Mitrankov for the PHENIX Collaboration

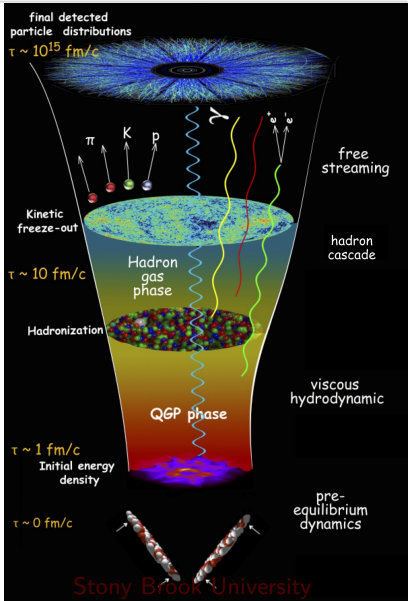
Dept. of Physics & Astronomy, Stony Brook University

March 23, 2026

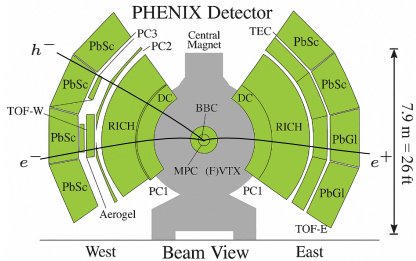
Motivation: studying QCD matter with different probes

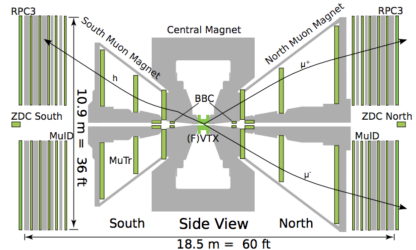


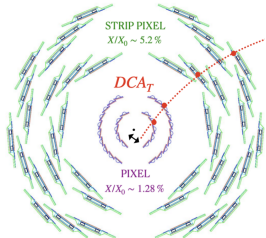


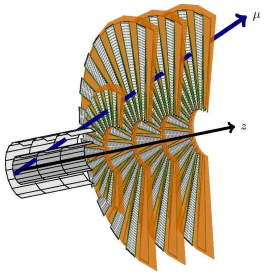


PHENIX Detector

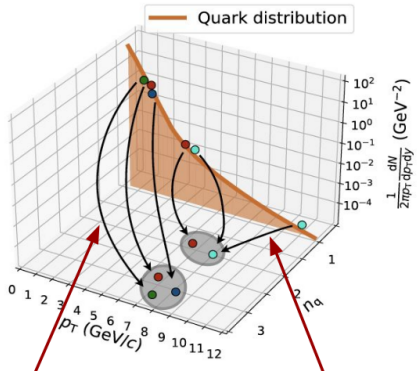








Hadronization at RHIC: recombination to fragmentation



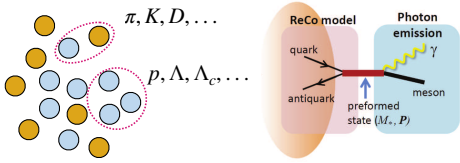
Recombining quarks:

$p_{meson} = p_{q1} + p_{q2}$

$p_{baryon} = p_{q1} + p_{q2} + p_{q3}$

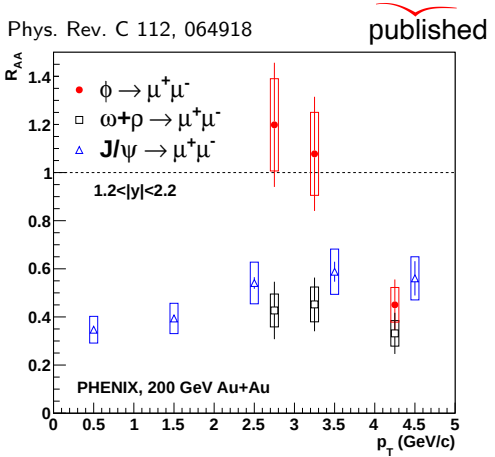
Fragmenting parton:

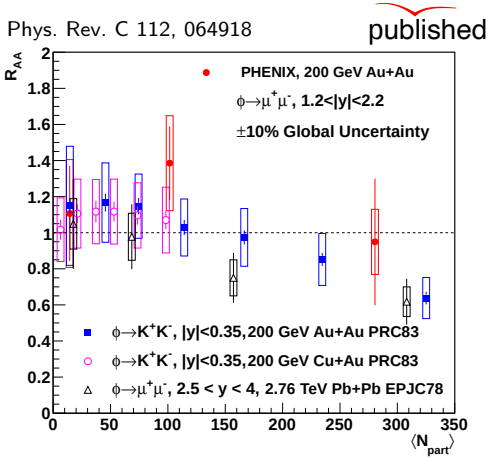
$p_h = z \cdot p_q$ with $z<1$



$$R_{AB} = \frac{1}{N_{coll}} \cdot \frac{A + B}{p + p}$$

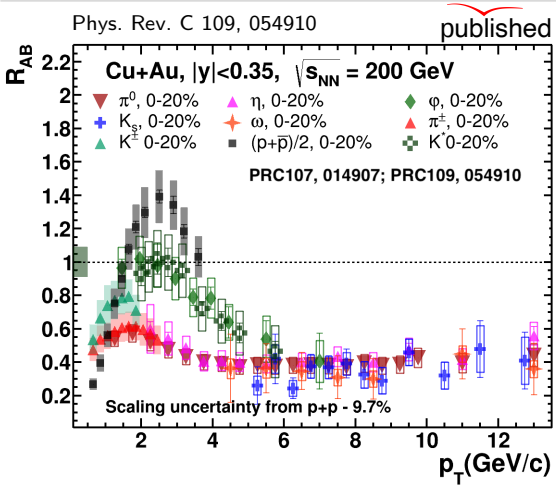
Strangeness: ϕ Meson at Forward Rapidity





- ϕ mesons show enhancement at intermediate p_T and suppression at high p_T

Soft Probes: Hadronization System&Species Dependence



Using multiple PID avenues in PHENIX, we measured in various systems:

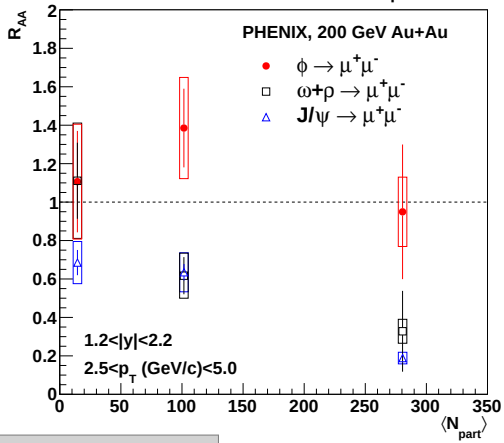
- **Baryon enhancement:** $(p+\bar{p})/2$ shows the largest enhancement at mid-p_T.
- ϕ **as a discriminator:** ϕ is enhanced, but **less than baryons** and closer to the **meson-like** systematics ⇒ not purely a mass effect; sensitive to hadronization (coalescence vs fragmentation).
- **High** p_T**:** all species converge to a similar suppression level ⇒ fragmentation + parton energy loss dominates.

$$R_{AB} = \frac{1}{N_{coll}} \cdot \frac{A+B}{p+p}$$

System Size Dependence of ϕ and Baryon Enhancement

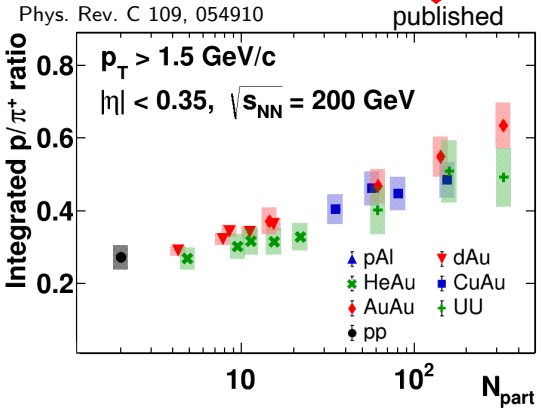
Phys. Rev. C 112, 064918

published



Phys. Rev. C 109, 054910

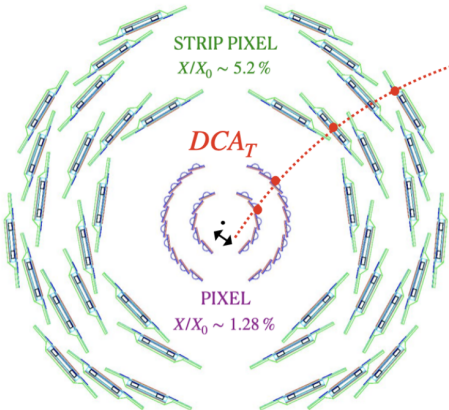
published

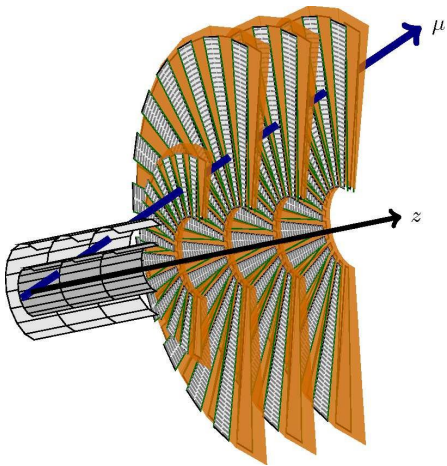


- The intermediate-p_T enhancement grows smoothly with system size.

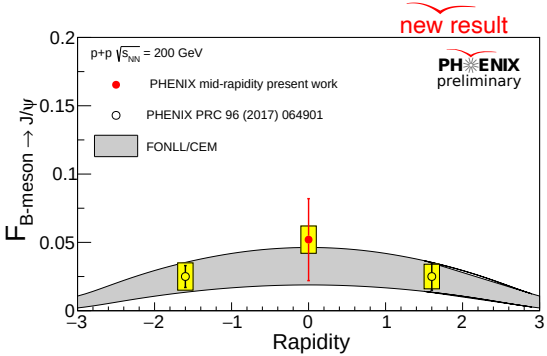
Chaitanya Prasad
Tue., 9:25

Heavy Flavor at PHENIX

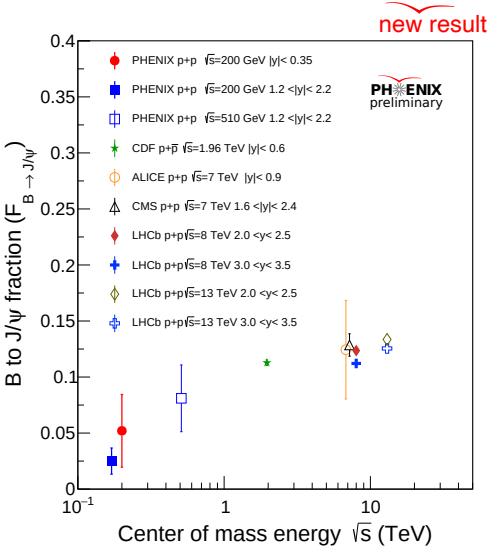




Bottom Quark Production in p+p Collisions

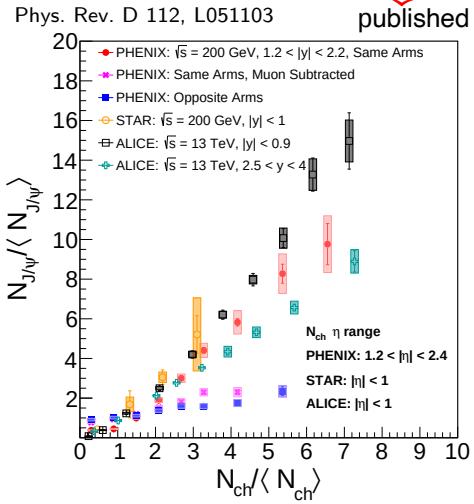


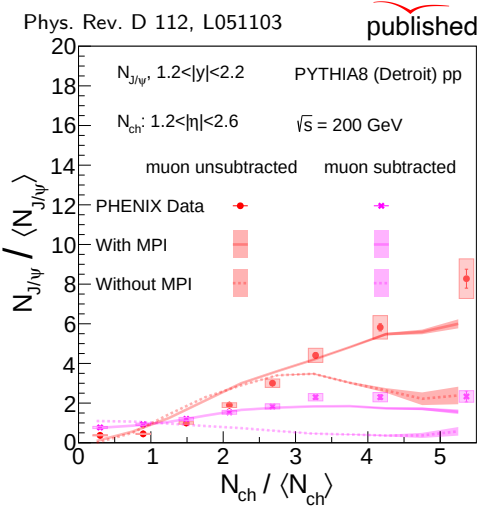
- Fraction of J/ψ from B decays evolves with $\sqrt{s}$ and rapidity, consistent with FONLL predictions.



Ming Liu
Wed., 9:25

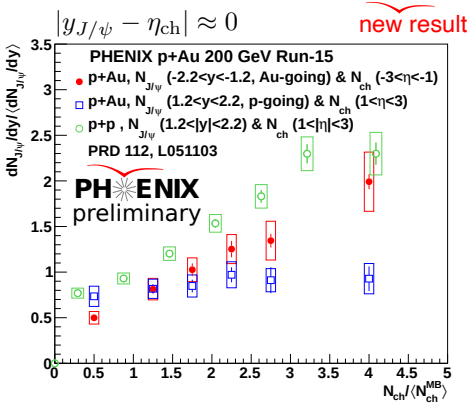
Charmonium Production vs. Event Activity in p+p

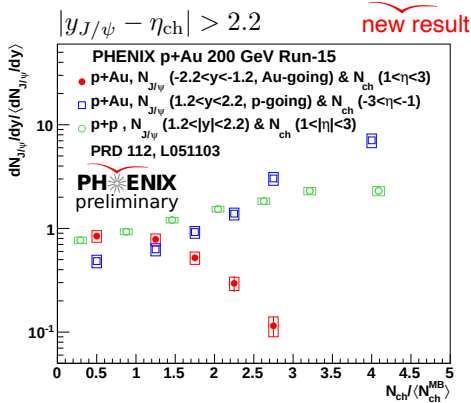




- J/ψ production versus charged-particle multiplicity in p+p is described by PYTHIA with MPI.

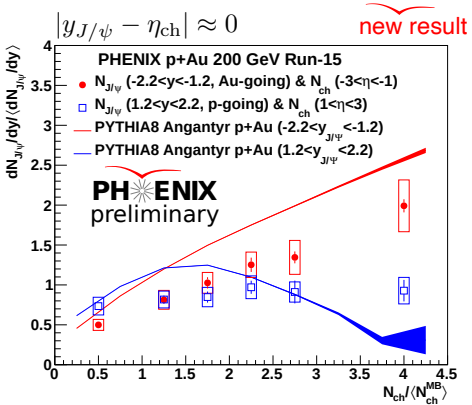
Charmonium Production vs. Event Activity in p+Au

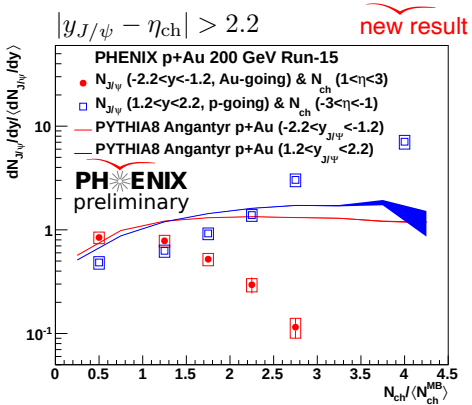




- The J/ψ multiplicity dependence is much stronger for large-gap charged particles than for particles in the same rapidity region.
- This indicates a pronounced long-range correlation in p+Au collisions.

Charmonium Production vs. Event Activity in p+Au

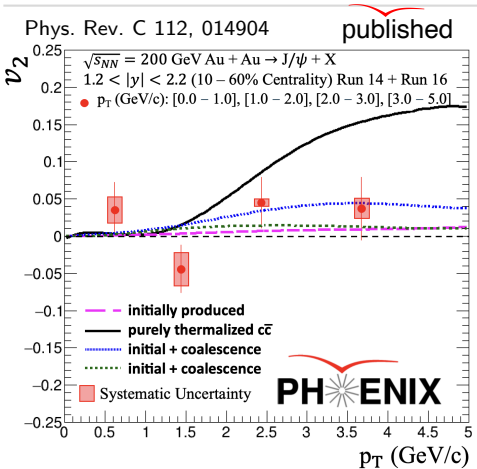


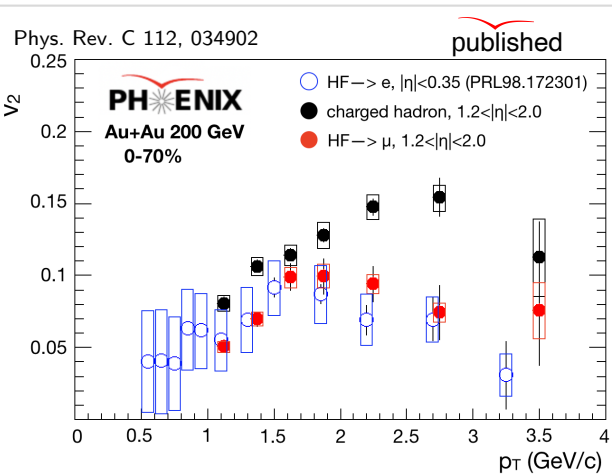


- In the long-range case, the J/ψ yield increases with $N_{\rm ch}$ for forward-J/ψ production (small-x in Au), but decreases for backward-J/ψ production (large-x in Au).
- Pythia8/Angantyr with MPI does not describe this large-separation pattern.

Ming Liu
Wed., 9:25

Heavy-Flavor Flow in Au+Au Collisions

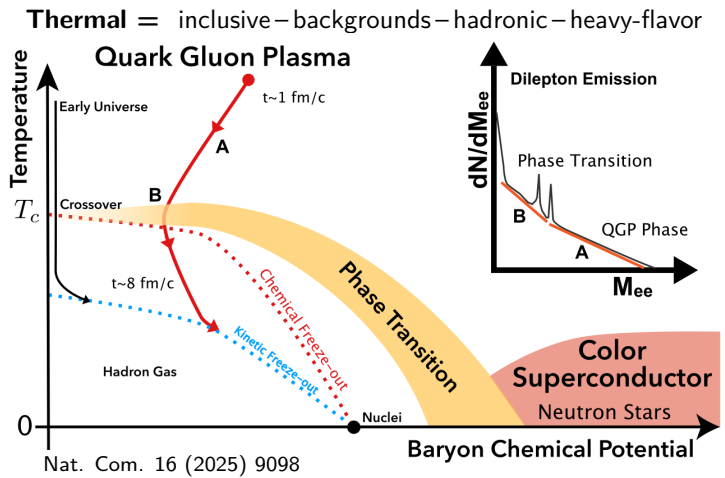


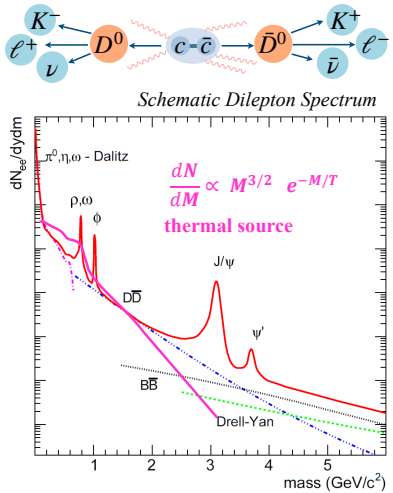


- PHENIX observes open heavy-flavor flow, providing evidence for strong heavy-quark interactions with the medium.

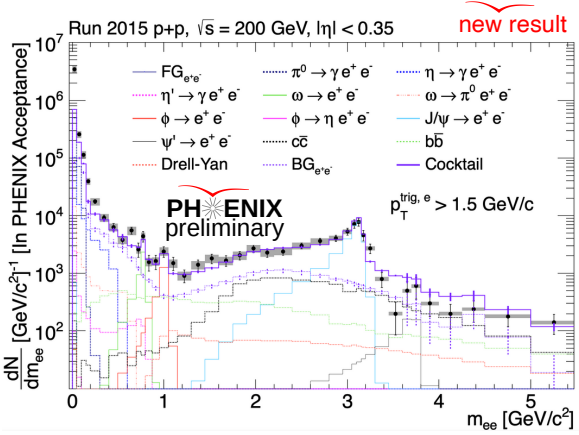
Chaitanya Prasad
Tue., 9:25

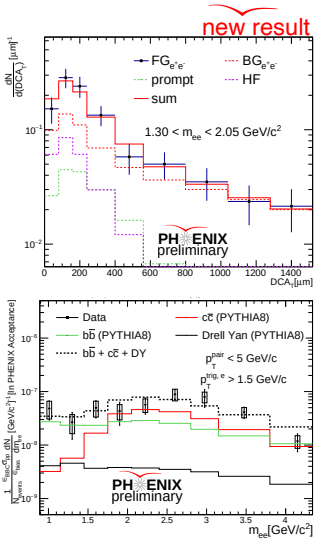
From Heavy Flavor to Thermal Dielectrons in Au+Au





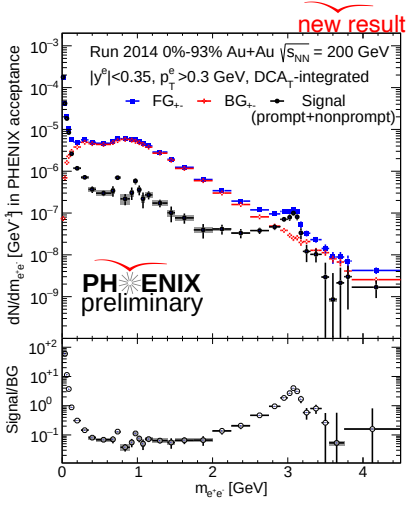
Dielectrons in p+p Collisions

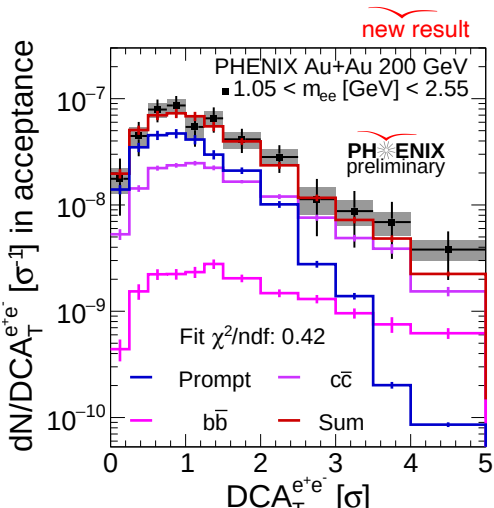




- The hadronic cocktail and the Pythia Detroit tune describe the data well.

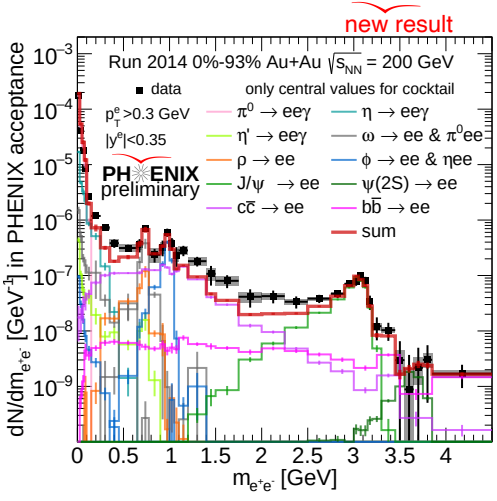
Au+Au Dielectrons: separating HF and extracting the excess

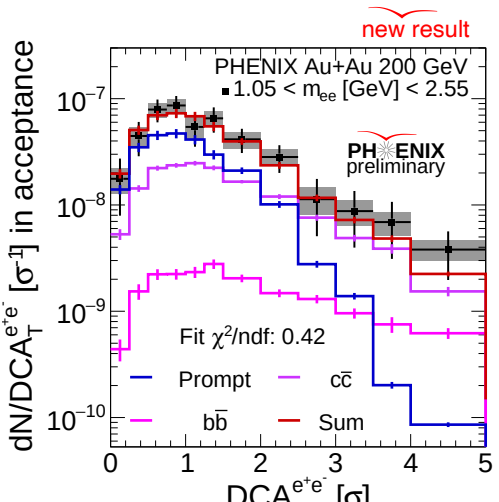




$$DCA_T^{e^+e^-} = \sqrt{\left(DCA_T^{e^+}/\sigma_{e^+}\right)^2 + \left(DCA_T^{e^-}/\sigma_{e^-}\right)^2}$$

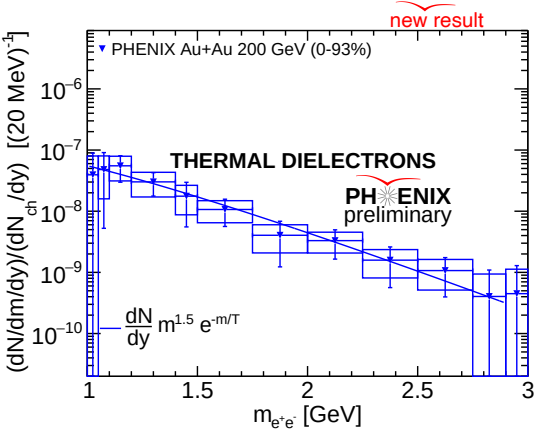
Au+Au Dielectrons: separating HF and extracting the excess

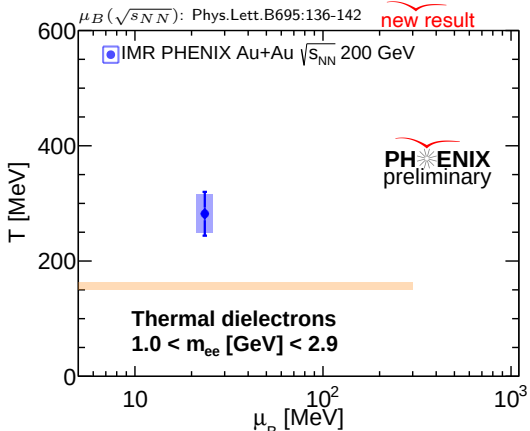




- Pair-DCA constrains heavy flavor directly in data, allowing us to isolate the excess in the IMR.

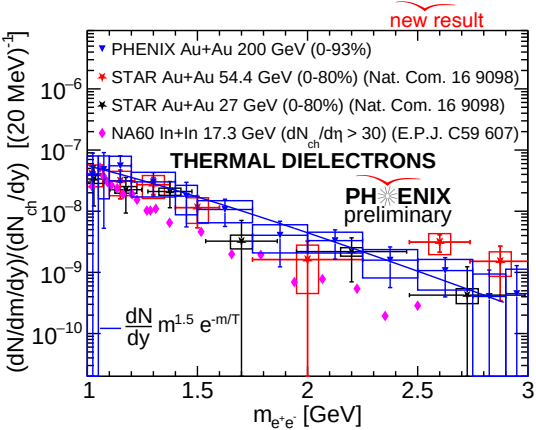
Thermal Dielectrons: Mass Spectra and Measured T

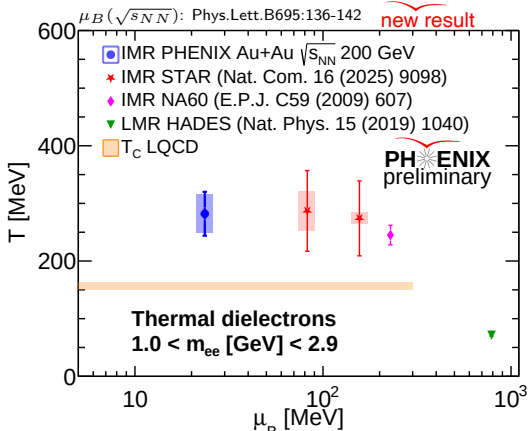




- **First** direct measurement of the QGP temperature at top RHIC energy in Au+Au collisions, enabled by the extraction of the prompt IMR component using DCA.
- Only a slight increase in T_{IMR} is observed from SPS.

Thermal Dielectrons: Mass Spectra and Measured T



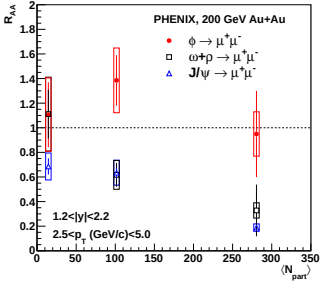


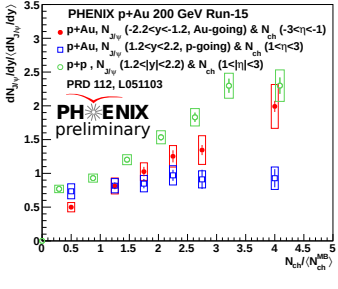
- **First** direct measurement of the QGP temperature at top RHIC energy in Au+Au collisions, enabled by the extraction of the prompt IMR component using DCA.
- Only a slight increase in T_{IMR} is observed from SPS.

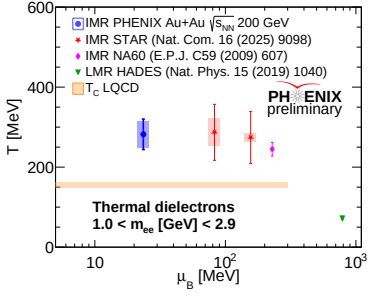
Mariia Mitrankova
Wed., poster session

Summary

- Interplay of recombination and fragmentation evolves smoothly with system size.
- J/ψ production in p+p and p+Au shows a strong dependence on event activity: MPI describes the p+p, while in p+Au additional mechanisms to explain the long-range correlation are needed.
- IMR dielectrons in p+p are well described by HF contributions from the PYTHIA Detroit tune; in Au+Au, after isolating the HF component, a clear prompt excess is observed, consistent with thermal radiation at temperatures similar to those extracted at lower collision energies.







PHENIX talks and posters

- PHENIX results at SQM2026 are also featured in:
  - **Talk:** *Tue 9:25*
    PHENIX Measurements of Identified Charged Hadrons and Forward ϕ-meson in Small and Large Systems
    Chaitanya Prasad
  - **Talk:** *Wed 9:25*
    Heavy-quark production mechanisms and hadronization in p+p and p+Au collisions in PHENIX
    Ming Liu
  - **Poster:** *Wed poster session*
    Measurement of thermal radiation in Au+Au collisions at 200 GeV by PHENIX
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Thank you for your attention!