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Energy loss and flow of charm and bottom quarks from single electron measurements in Au+Au collisions at PHENIX

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Heavy flavor is powerful probe to study properties of QGP

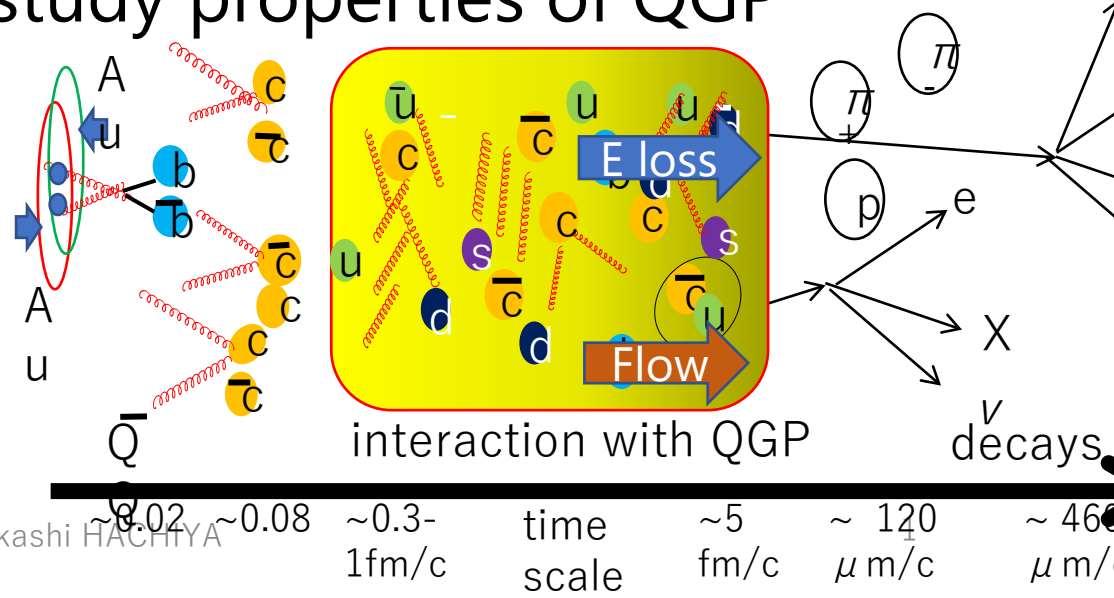
Mainly created at early stage of the collision

Production can be calculated by pQCD

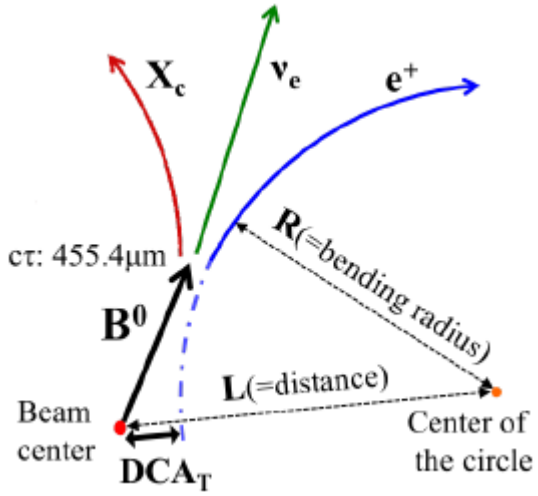
Passing through QGP

Suffer energy loss and flow effects

p_T and angular distributions can be modified in QGP

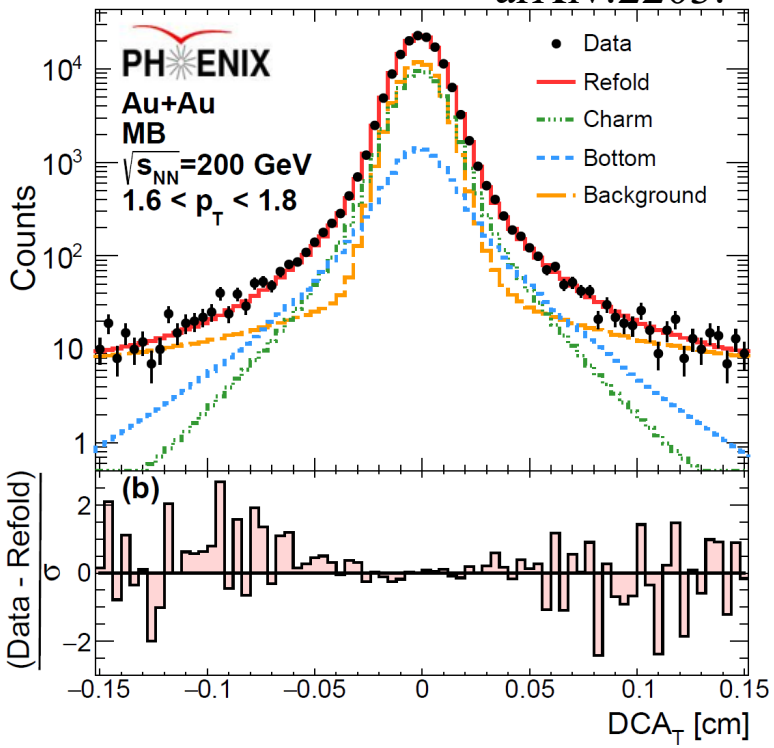


Bottom and charm separation



- Charm and bottom separation by the unfolding method using the distance-of-closest-approach (DCA) and p_T distribution
- Au+Au and p+p are analyzed by the same analysis technique
- p+p baseline updated using 2015 dataset

arXiv:2203.



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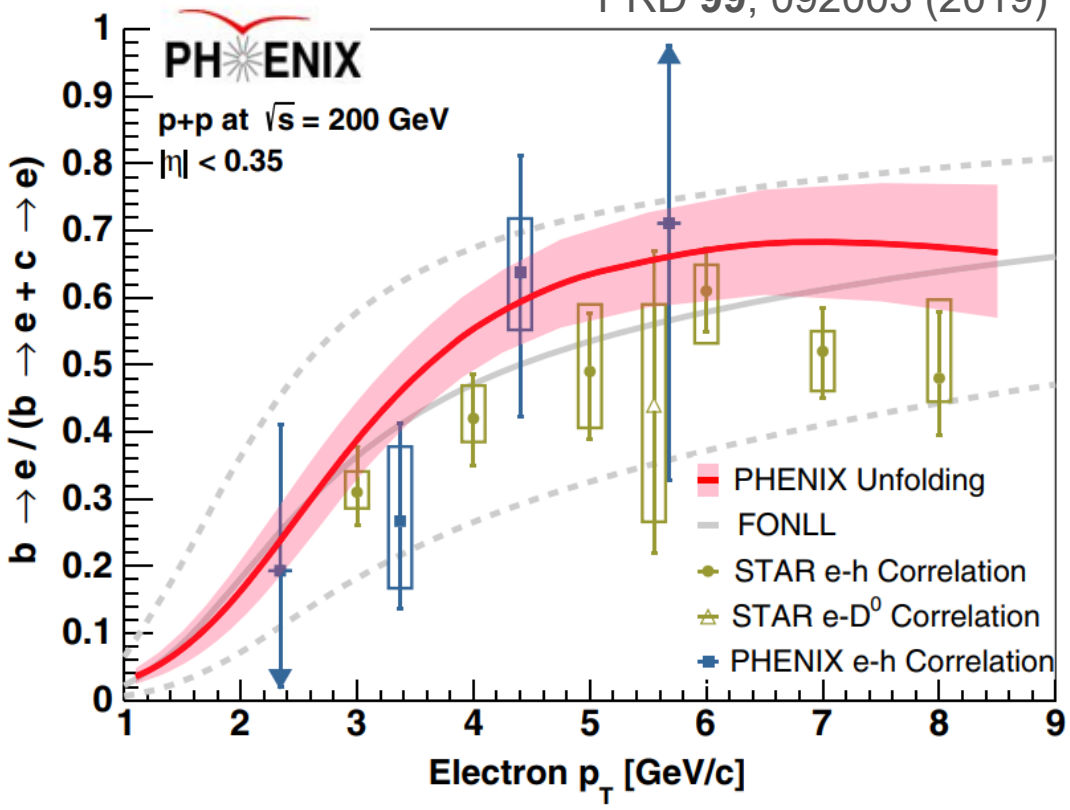
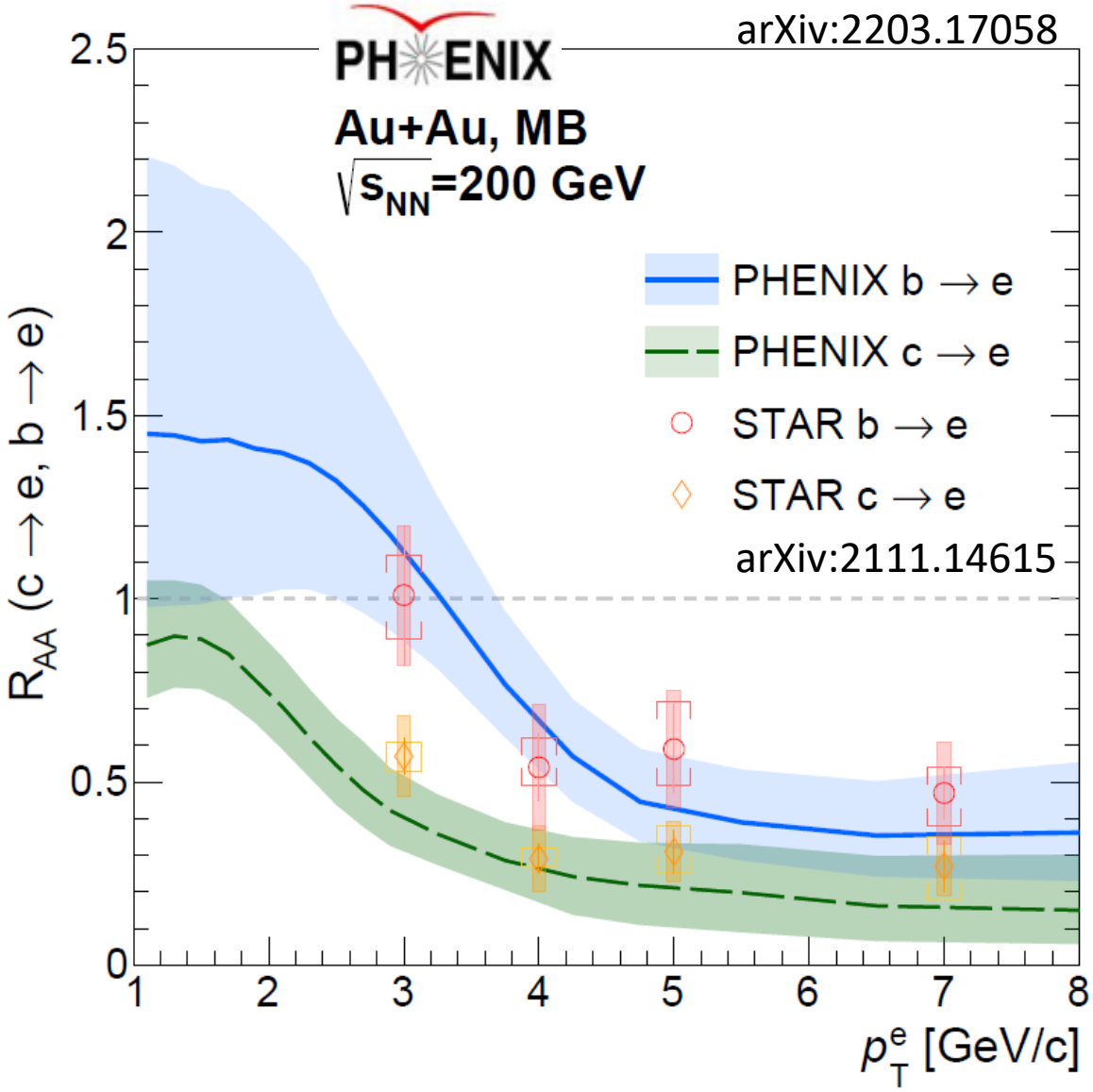


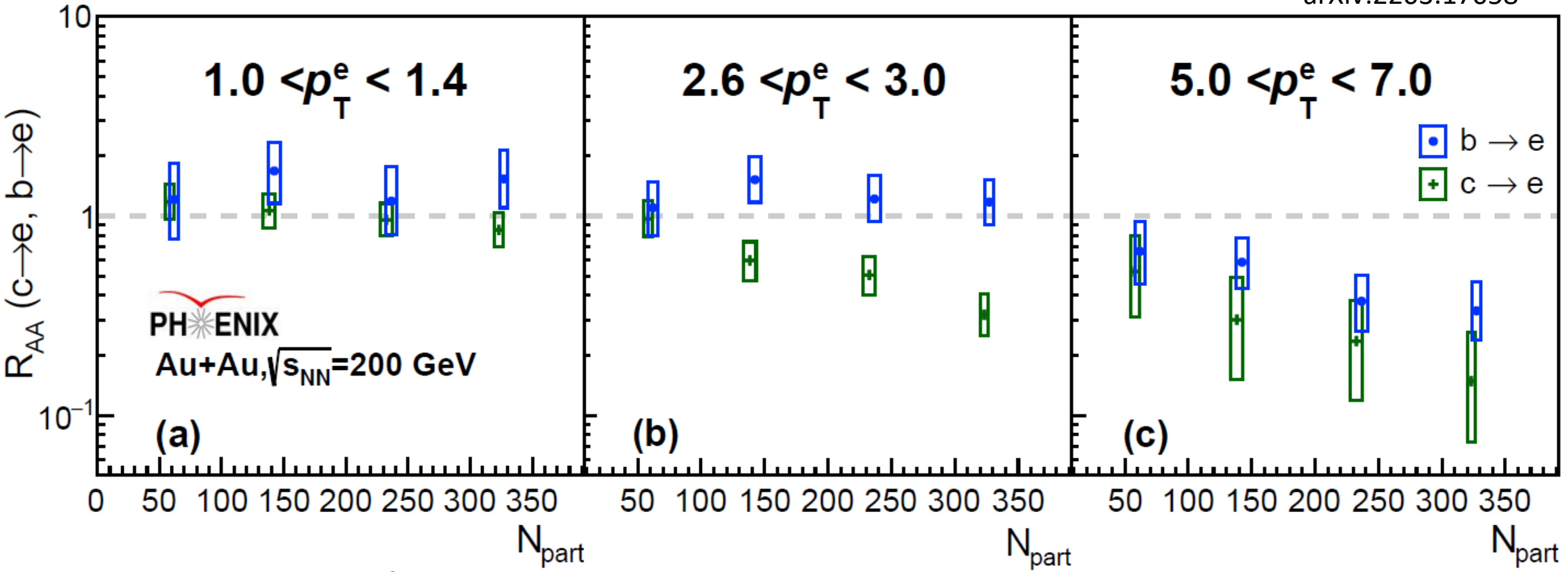
R_{AA}(b→e) & R_{AA}(c→e) in Au+Au 200GeV



- Nuclear modification factor R_{AA}
  - Broad p_T range : 1 – 8 GeV/c
  - Small uncertainty with new p+p baseline
- Centrality and p_T dependence
  - Low p_T : R_{AA}(b->e) ~ R_{AA}(c->e) = 1
  - Mid p_T : R_{AA}(b->e) > R_{AA}(c->e)
  - High p_T: R_{AA}(b->e) ~ R_{AA}(c->e) < 1
- Bottom suppression is different from charm
  - A clear p_T dependence
- PHENIX MB and STAR 0-80% are in good agreement within uncertainties

Charm and Bottom R_{AA} vs Npart

arXiv:2203.17058



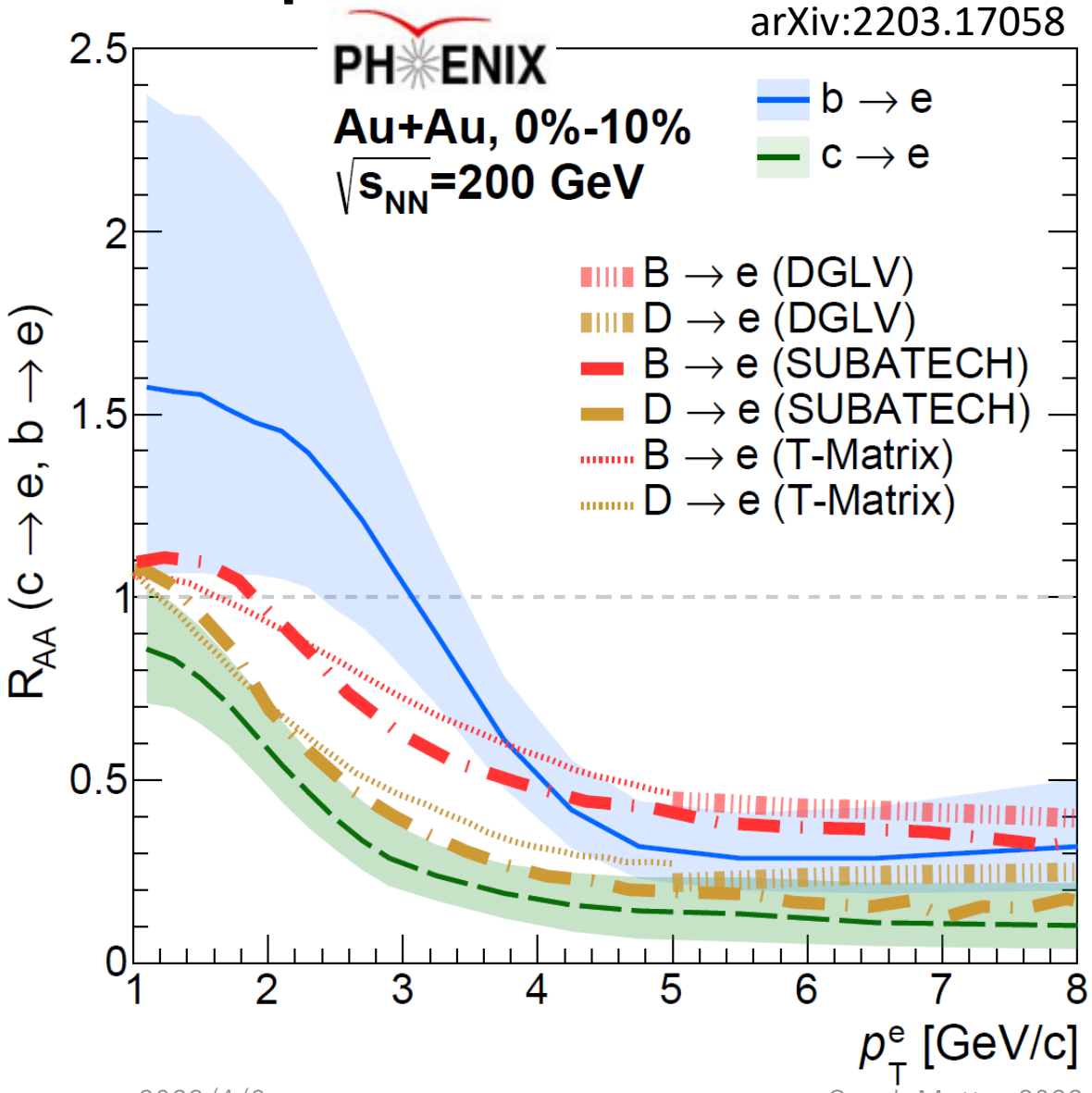
$R_{AA}(c\rightarrow e) \sim R_{AA}(b\rightarrow e) \sim 1$

$R_{AA}(c\rightarrow e) < R_{AA}(b\rightarrow e)$
$R_{AA}(b\rightarrow e) \sim 1$

$R_{AA}(c\rightarrow e) \sim R_{AA}(b\rightarrow e) < 1$

Clear centrality and p_T dependence observed

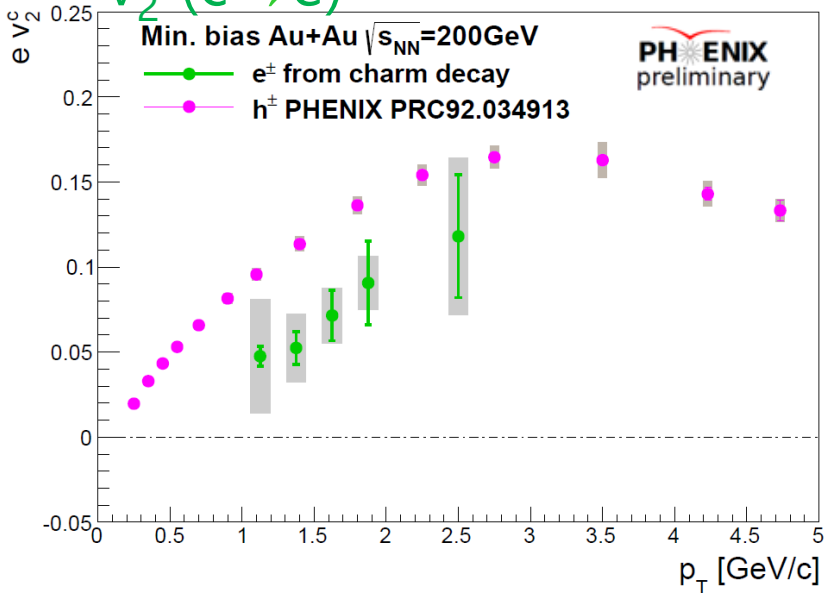
Comparison with Models



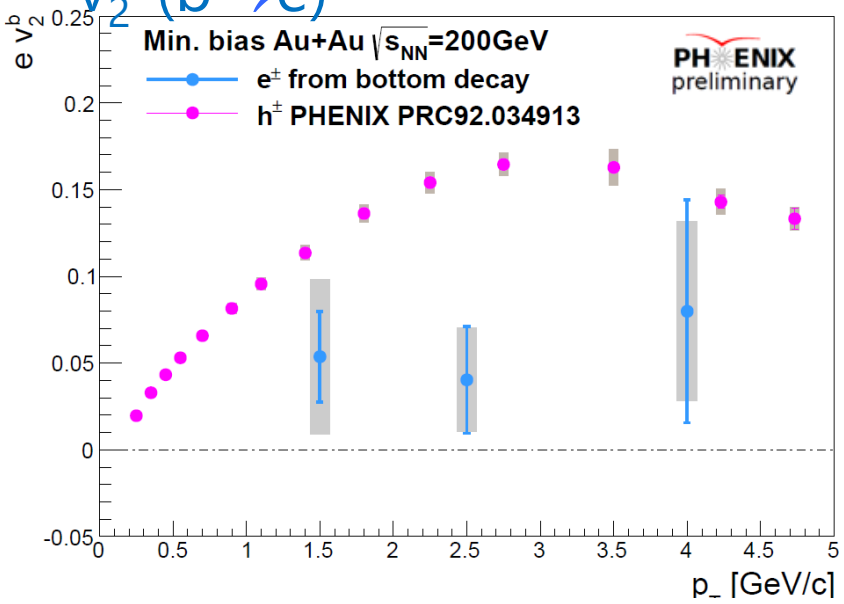
- Compared with 3 models
  - DGLV (Phys. Rev. C 90 034910)
    - E-loss + plasma w/ static potentials
  - SUBATECH (Phys. Rev. C 78 014904)
    - : E-loss + running coupling
  - T-Matrix + diffusion ($2\pi TD=4$) (Phys. Rev. Lett. 100 192301)
    - Strongly coupled QGP
- Models qualitatively consistent with data
  - Mass dependent energy loss agree with the mass dependent suppression
  - Bottom models underestimates the data
  - Charm models slightly higher than data

Toward final $v_2^c(c \to e)$ and $v_2^b(b \to e)$

$v_2^c(c \to e)$



$v_2^b(b \to e)$



- $c \to e$ v_2 is positive with ~3.5 sigma
- A hint of positive $b \to e$ v_2 with 1.1 sigma

- Outlook
  - Final v_2 result with improved yield unfolding
  - New analysis in Au+Au and small systems coming soon