Quenching of heavy flavors at the LHC

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[Based on PRD 71 (2005) 54027 and PLB 637 (2006) 362]

Last call for LHC predictions - CERN May 2007

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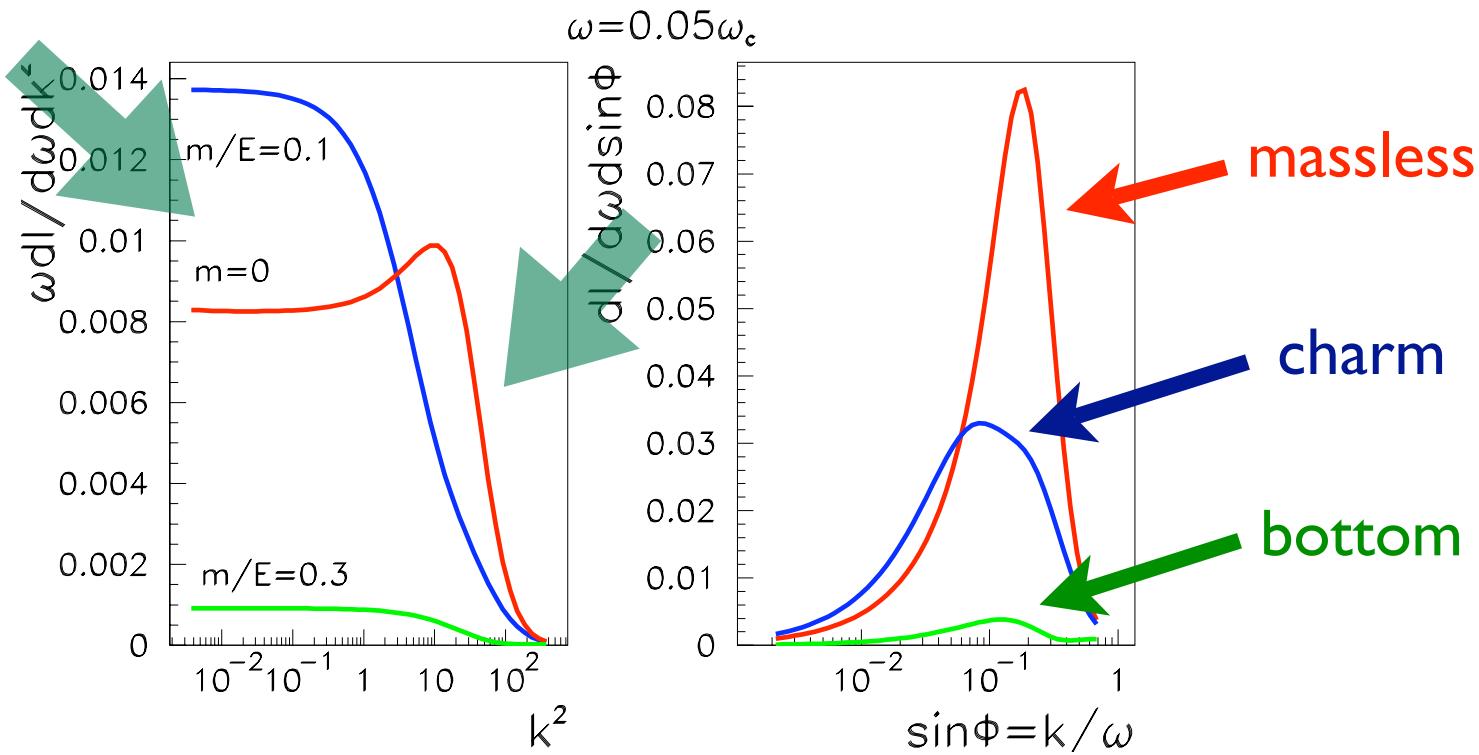
Radiation: massive vs massless quarks

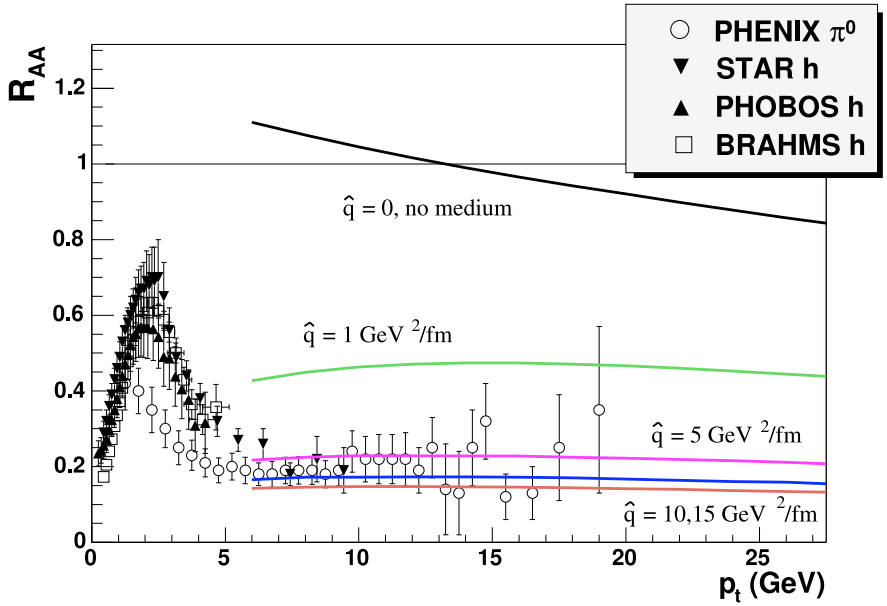
- Two competing effects
  - Suppression of radiation (similar to dead-cone in vacuum)
  - Smaller formation times for massive



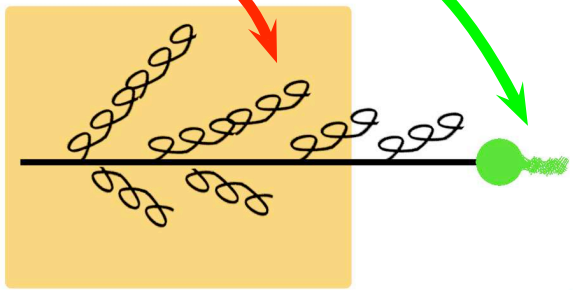
Radiation more collinear in the massive case and <u>energy loss is smaller</u>

Description of the light meson suppression

$$d\sigma^{AA\to h+X}_{(\mathrm{med})} = \sum_f d\sigma^{AA\to f+X}_{(\mathrm{vac})} \otimes \boxed{P_f(\Delta E, L, \hat{q})} \otimes D^{(\mathrm{vac})}_{f\to h}(z, \mu_F^2)\,.$$



[Eskola, Honkanen, Salgado, Wiedemann (2004)]



⇒ Multiple emission: Poisson distribution

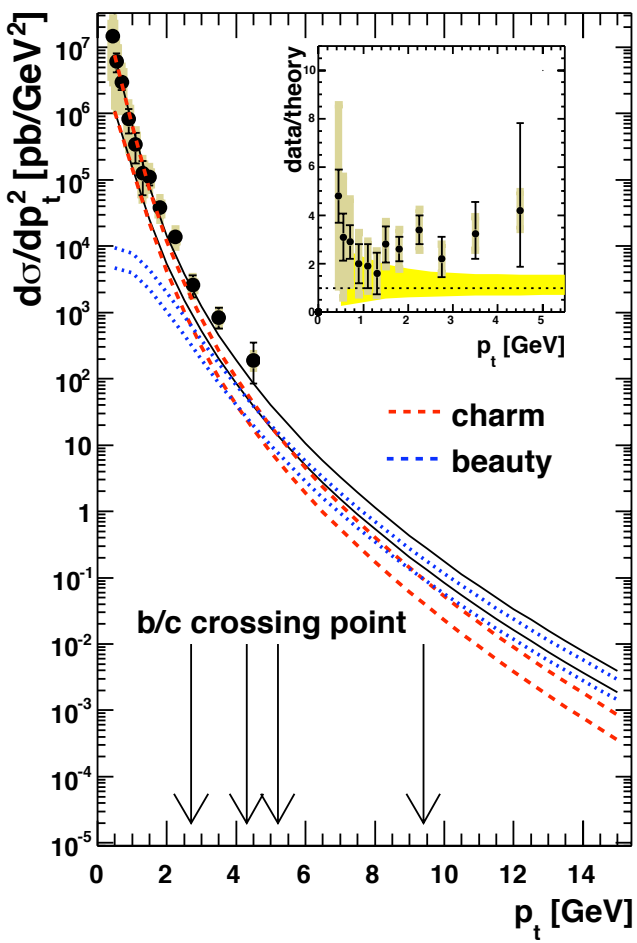
⇒ Hadronization in vacuum at high-p_t

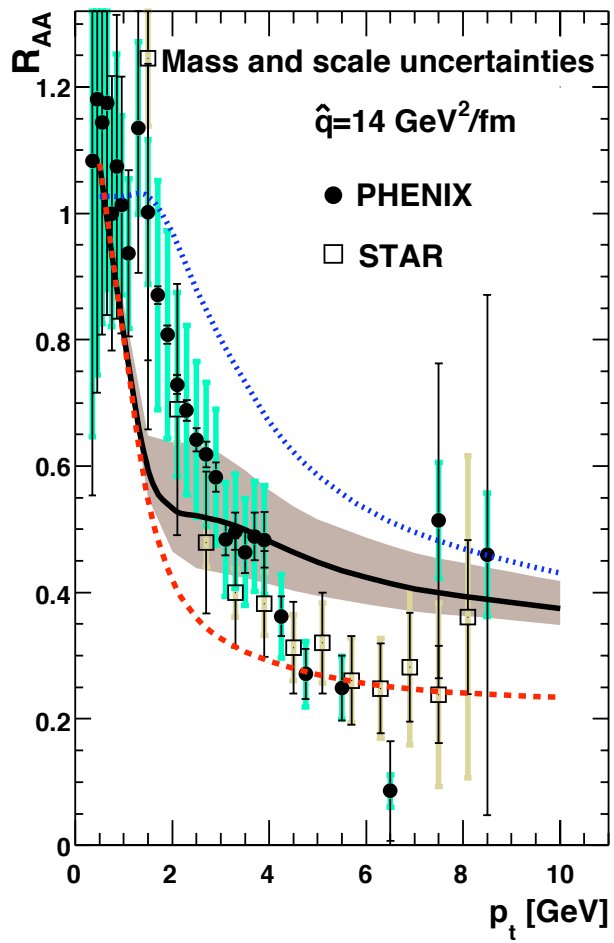
⇒ Data favors a large time-averaged transport coefficient

$$\boxed{\hat{q} \sim 5 \ldots 15 \frac{GeV^2}{fm}}$$

[Gyulassy, Levai, Vitev 2002; Arleo 2002; Dainese, Loizides, Paic 2004; Wang, Wang 2005; Drees, Feng, Jia 2005; Turbide, Gale, Jeon, Moore 2005...]

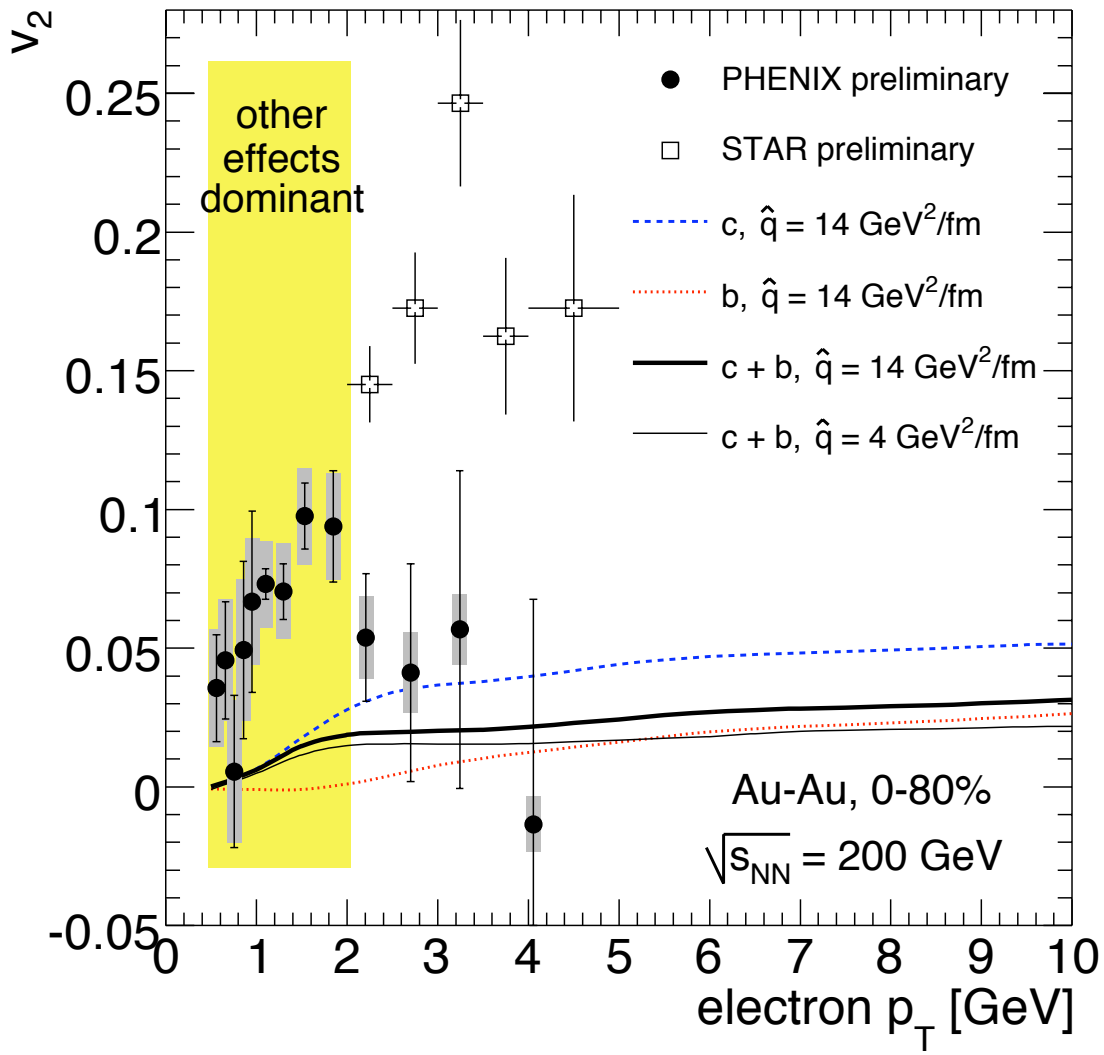
Model predictions for RHIC





⇒ Suppression very much dependent on c/b ratio

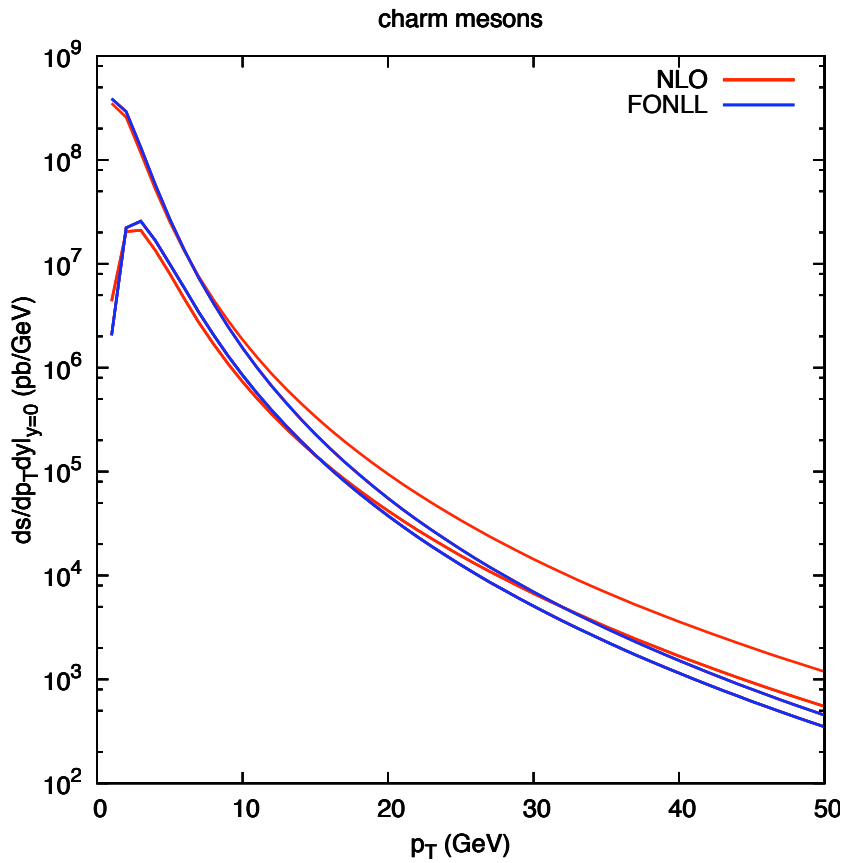
v_2 for electrons at RHIC

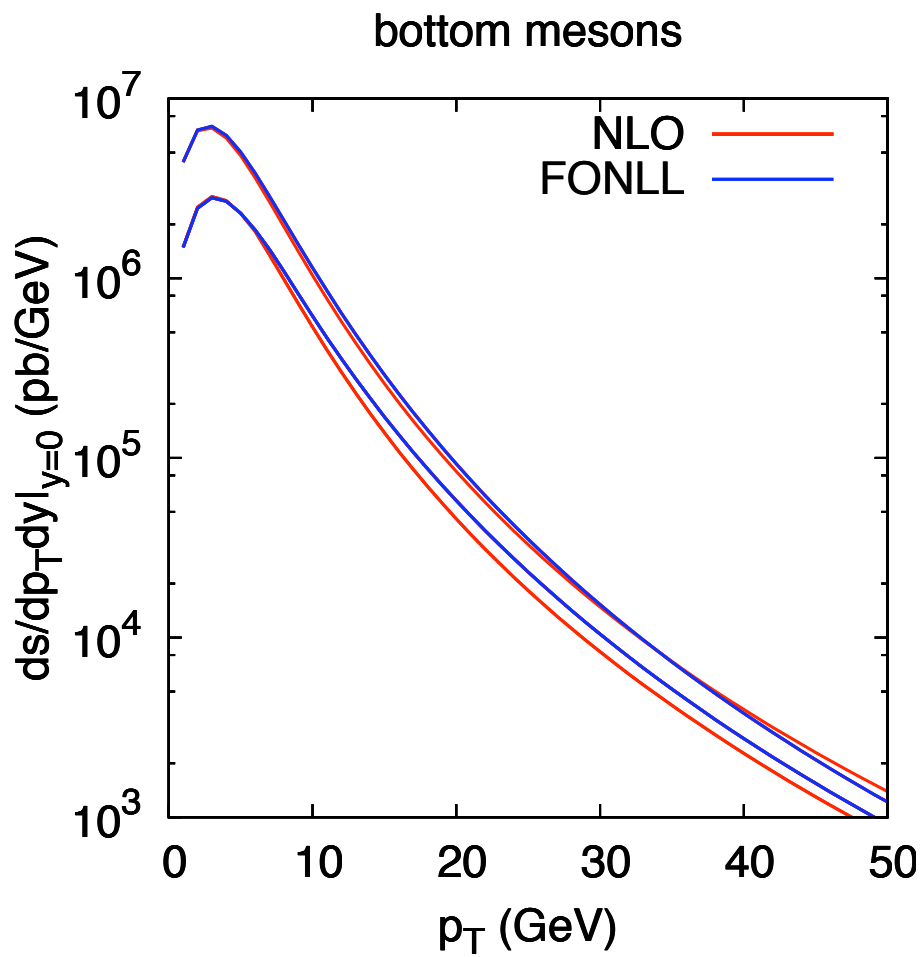


(not the latest data shown...)

The benchmark

⇒ FONLL and NLO predictions for the pp spectrum

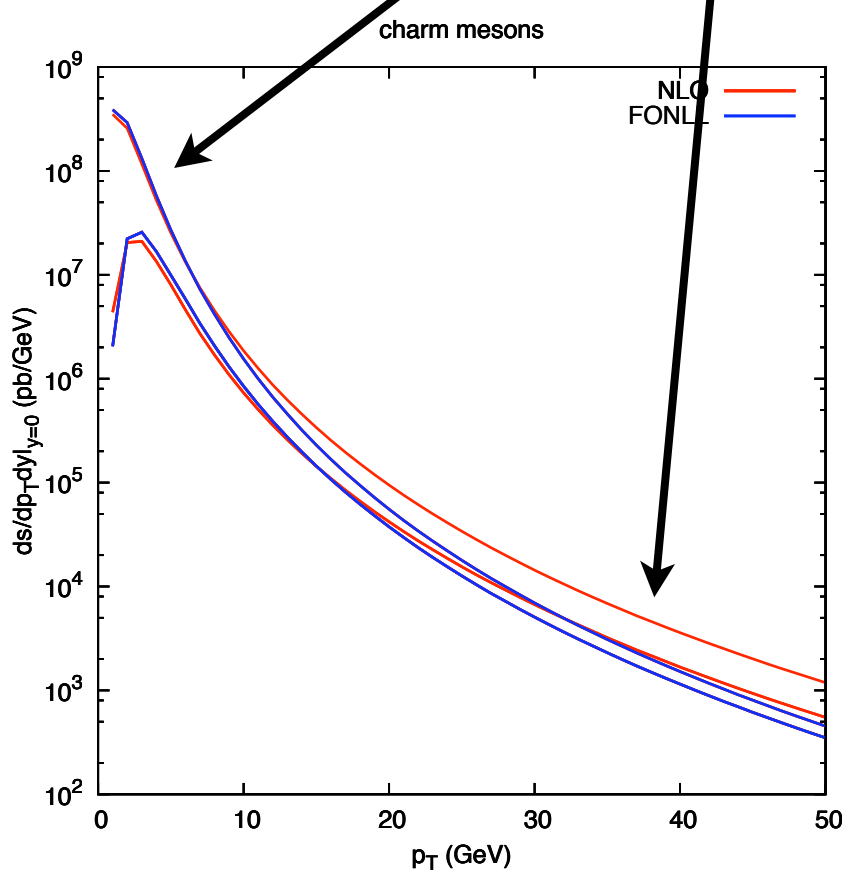




What is in FONLL?

FONLL=NLO+RES-(Double counting)

[Cacciari, Greco, Nason 1998]



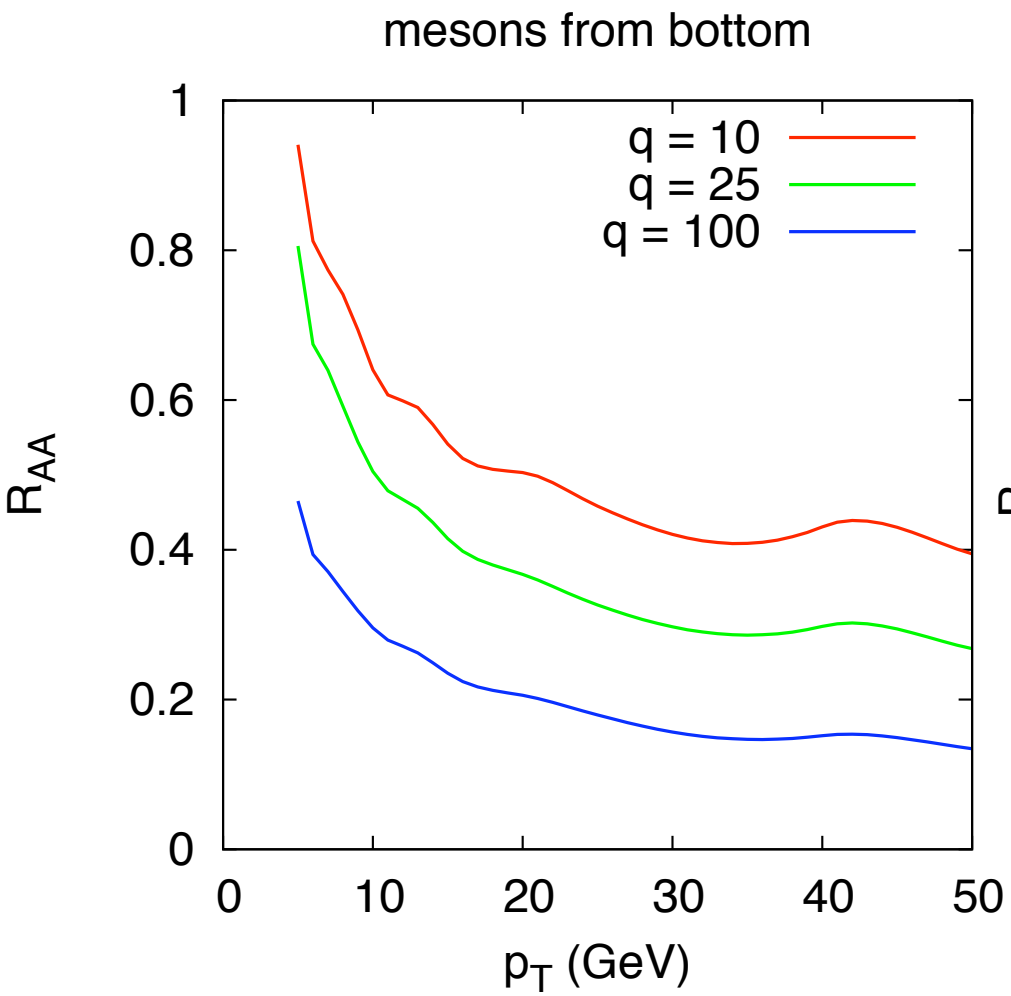
- Resummed logs

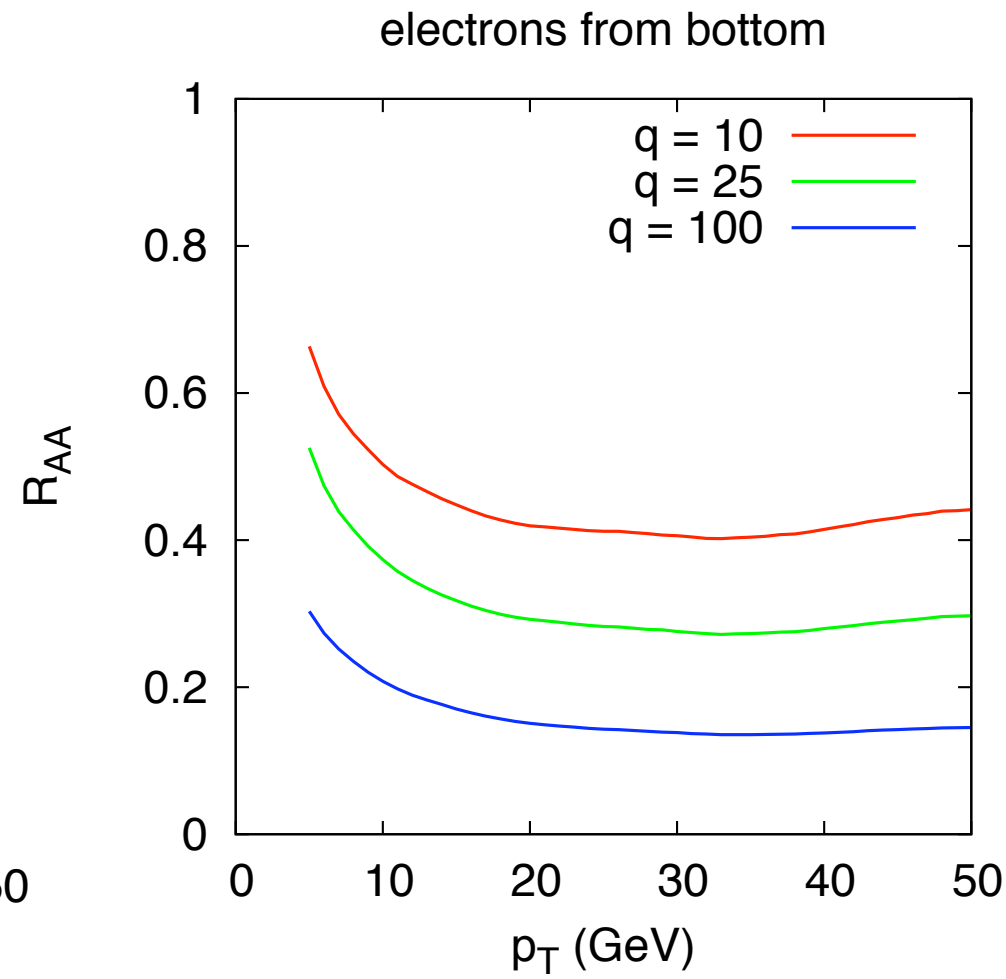
$$\left(\alpha_s \log \frac{p_t}{m_Q}\right)^n$$

  - in HQ PDFs and FFs

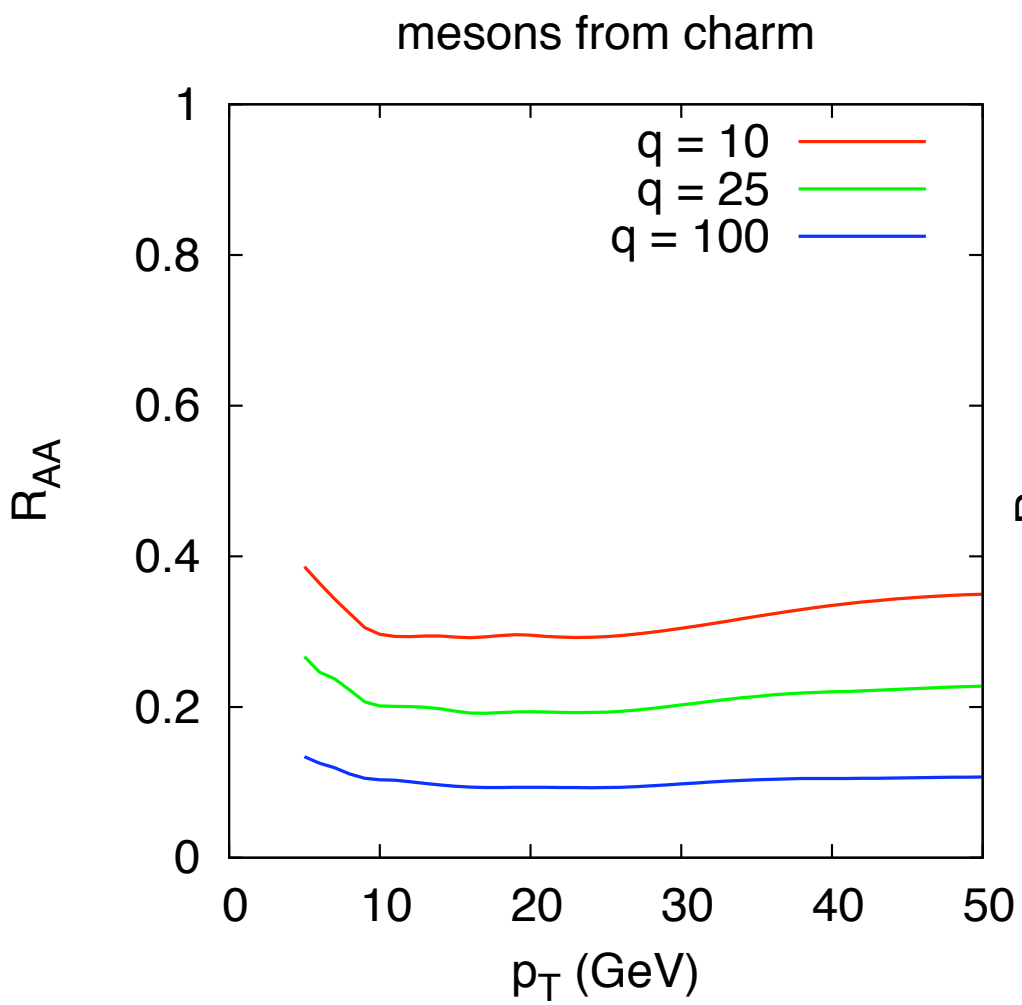
- Matching between NLO and RES to avoid double counting

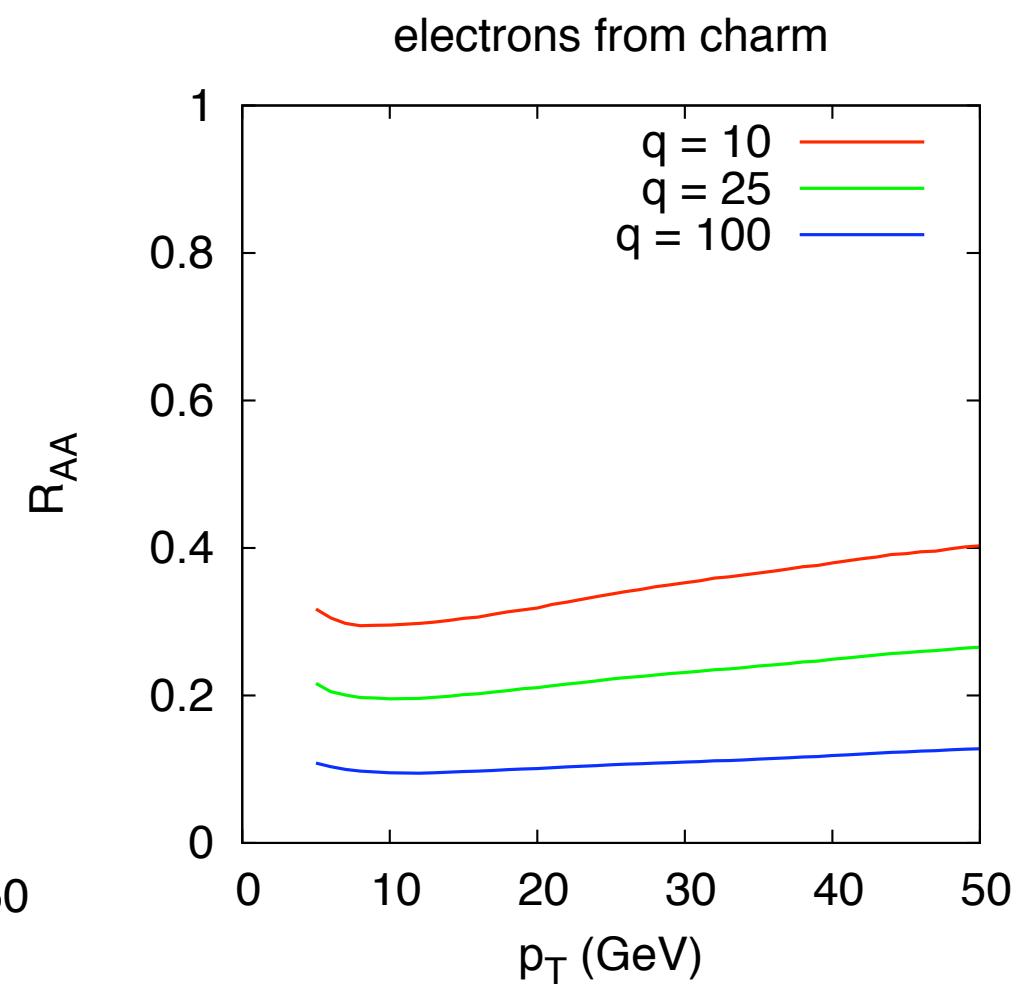
Suppression for bottom





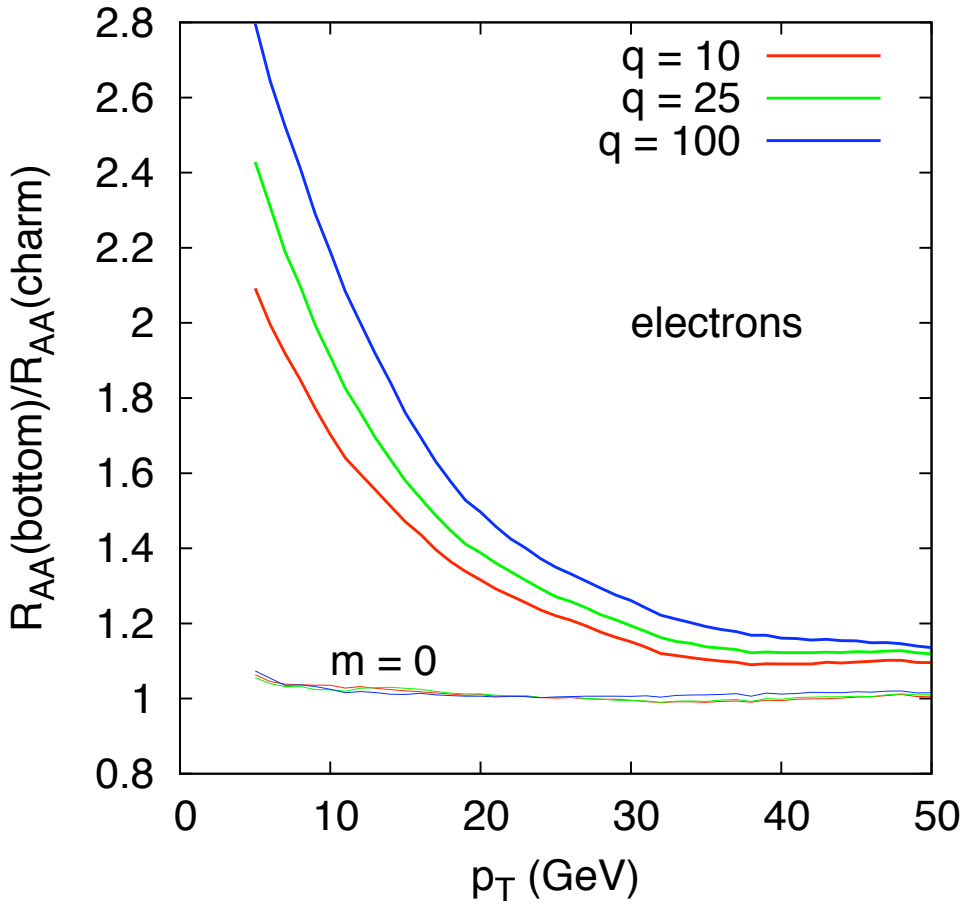
Suppression for charm

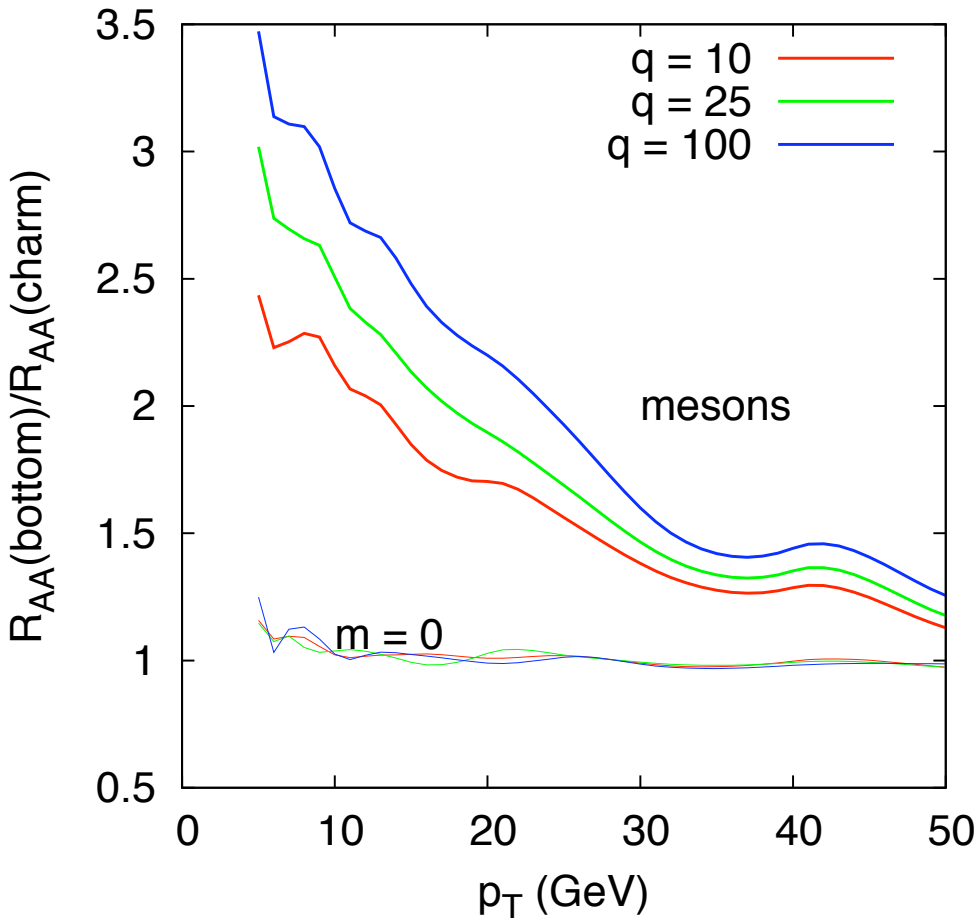




Mass effects

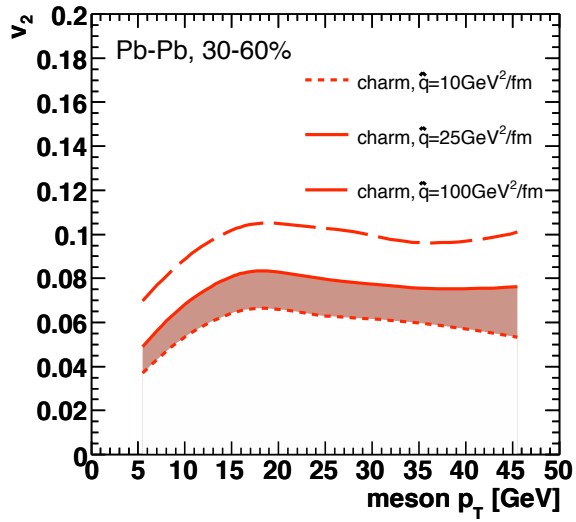
⇒ Double ratio sensitive to the mass terms (less sensitive to $\hat{q}$)

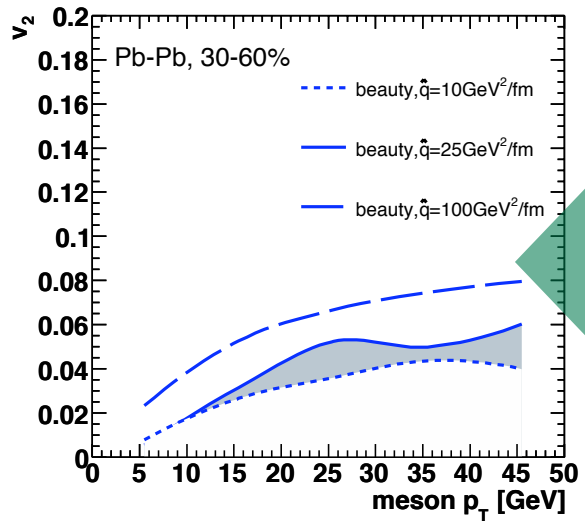




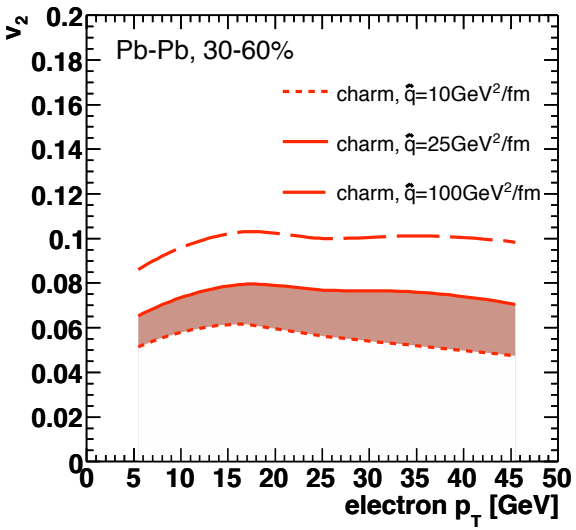
v_2 for mesons and electrons

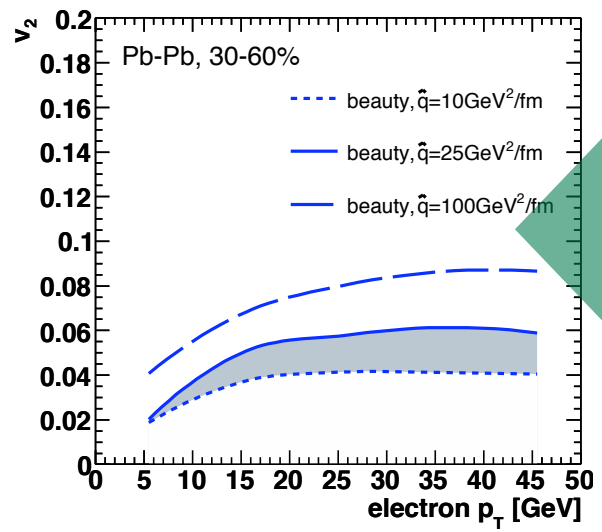
charm bottom





meson





electron

Conclusions

- Reasonable description of RHIC data within this formalism
  - Separation between charm and beauty needed
- Extrapolations to LHC are smooth
  - Charm to measure quark/gluon energy loss difference
  - Bottom to measure mass effects