Heavy flavor production in p+p collisions at RHIC

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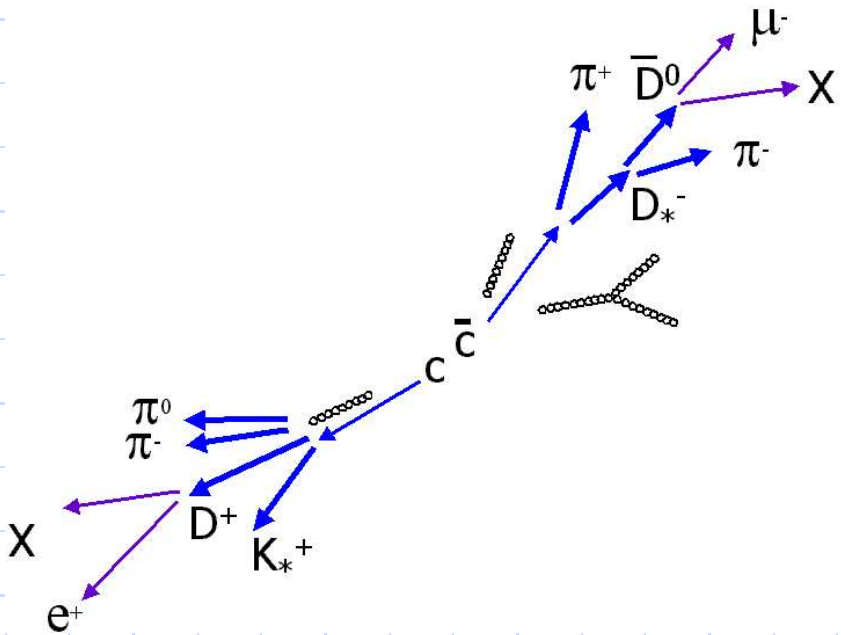
Outline

- Physics motivations
- Heavy flavor measurements at PHENIX
- Electron Cocktail
- Current status of p+p analysis
- Summary

Heavy flavor production

- Open charm (bottom) measurement in p+p collisions sets the baseline for d+Au and Au+Au measurements

- Test PYTHIA prediction for heavy flavor production in p+p collisions at $\sqrt{s}$ = 200 GeV



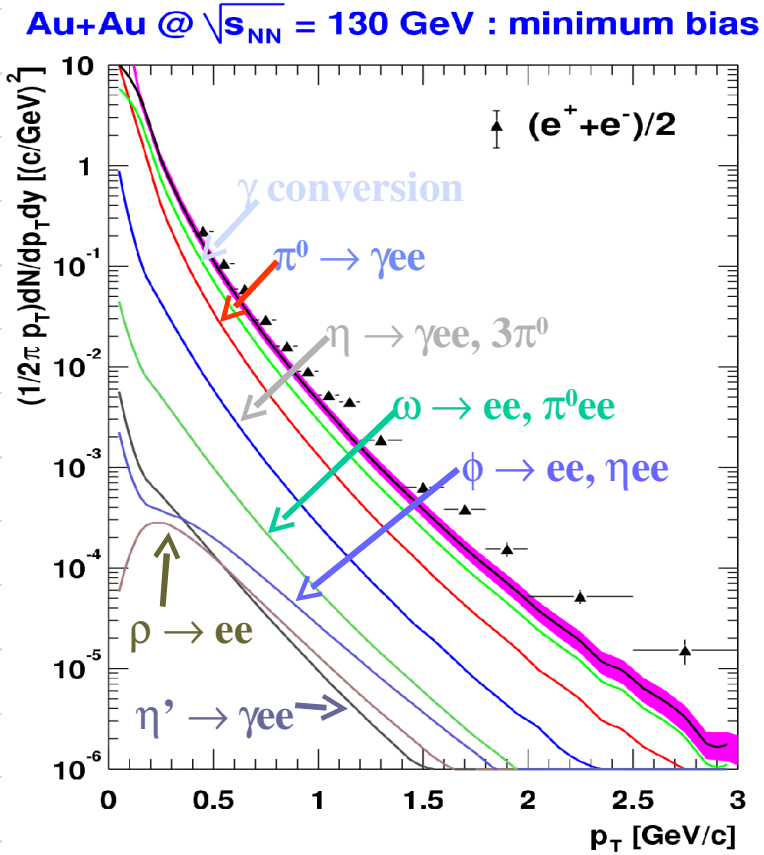
Open charm created from $c\bar{c}$ pair fragmentation

Heavy flavor measurements at PHENIX

- Open charm cross section was measured in Au+Au collisions at $\sqrt{s_{NN}}$ = 130, 200 GeV through single electron spectra analysis

- Two analysis implemented
  - Electron Cocktail for Au+Au $\sqrt{s_{NN}}$ = 130 GeV (see figure) PHENIX, PRL 88 (2002)

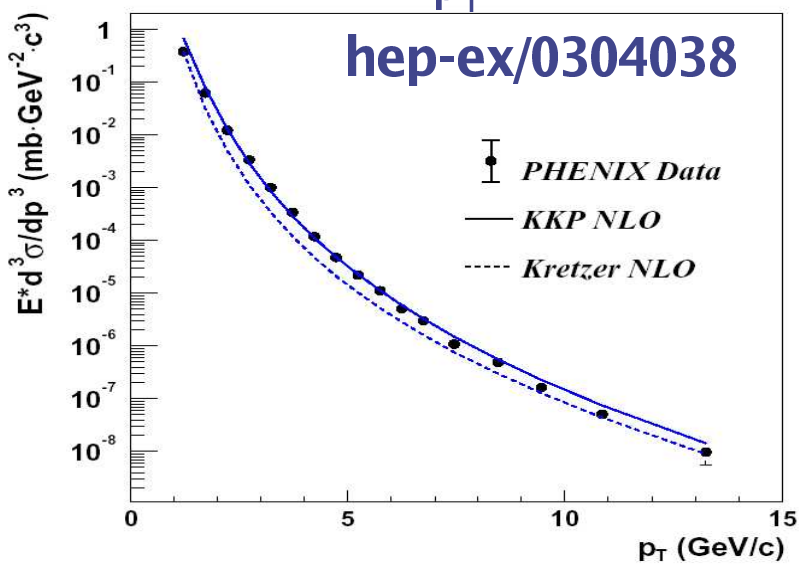
  - Converter subtraction for Au+Au $\sqrt{s_{NN}}$ = 200 GeV



Electron Cocktail method

- Calculate inclusive single electron distribution from all known electron sources:
  - π^0 Dalitz decay (dominant contributor at low pt)
  - Photon convertions in PHENIX material
  - Other light meson's (η, η', ρ, ω, ϕ) leptonic decays

π^0 invariant p_T distribution

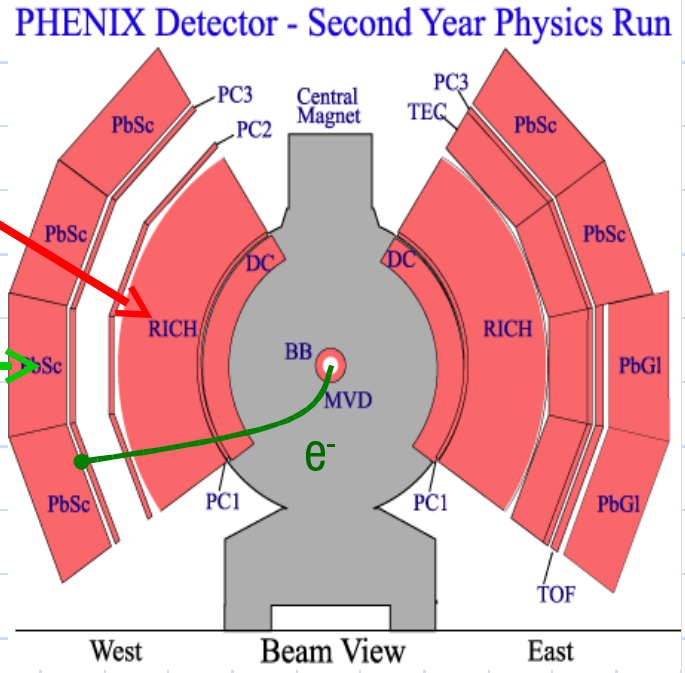


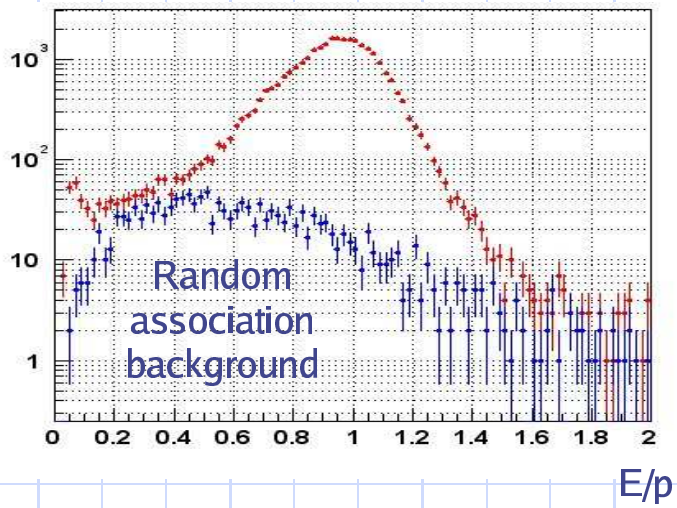
- Input to the Cocktail
  - π^0 invariant p_T distribution fitted by "power law" function
  - Light meson ratios were taken from SPS, ISR, FNAL, RHIC data
  - Relative normalization to π^0 yield
  - m_T scaled "power law" function momentum distribution of light mesons

- Excess of the data over the Cocktail prediction can be interpreted as heavy flavor semi-leptonic decay contribution

PHENIX Detector in Run02

- PHENIX detector has unique electron ID capabilities
- Electron is tagged by Ring Imaging Cherenkov Detector
- Energy of the Electromagnetic Calorimeter cluster and momentum of the track should match each other
- Energy over momentum ratio of signal and random background is shown below

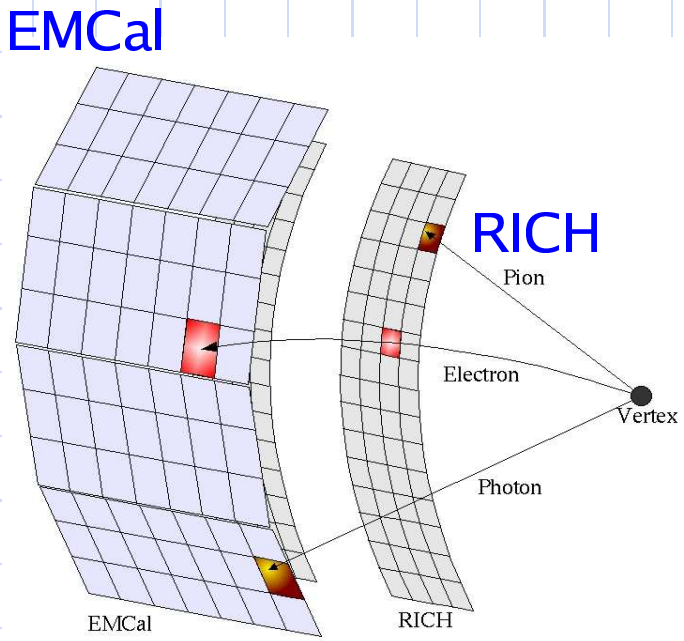


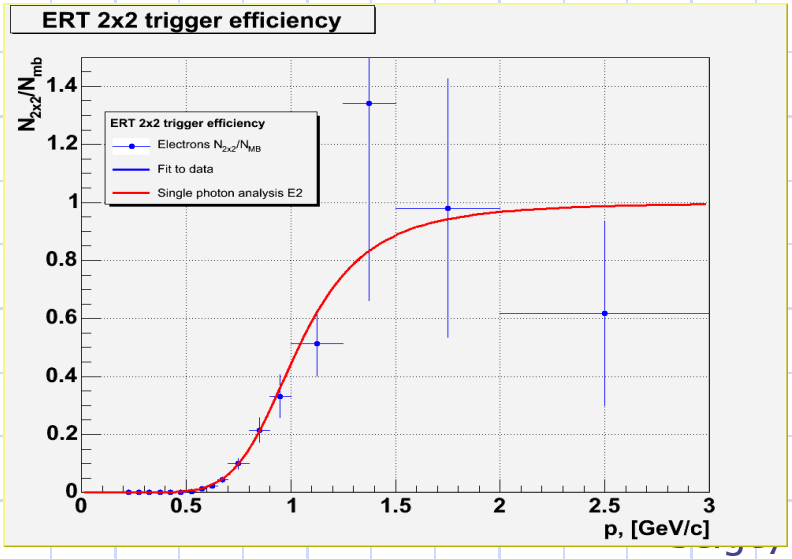


- Level 1 electron trigger was enabled to enhance high p_T electron sample

Level 1 ERT trigger at PHENIX

- ERT trigger on-line matches RICH hit position with EMC energy, deposited in 2x2 tile region
- Threshold on deposited energy tags electrons with energy higher then the threshold (~700 MeV)

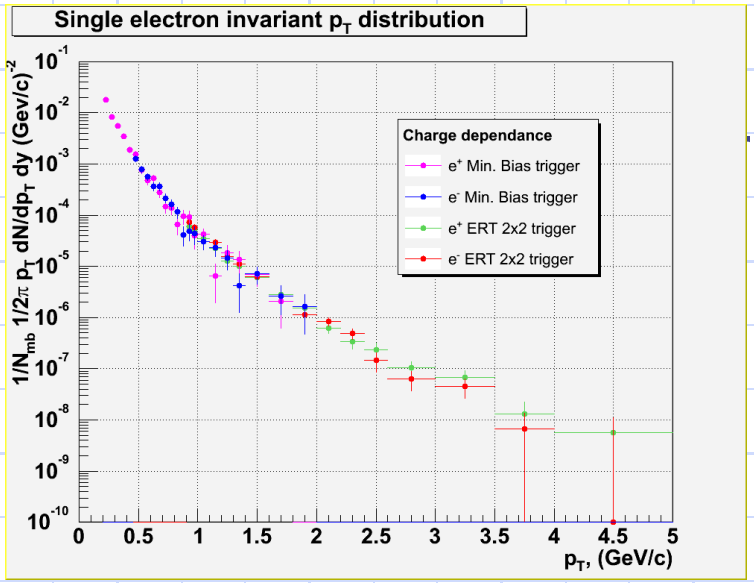


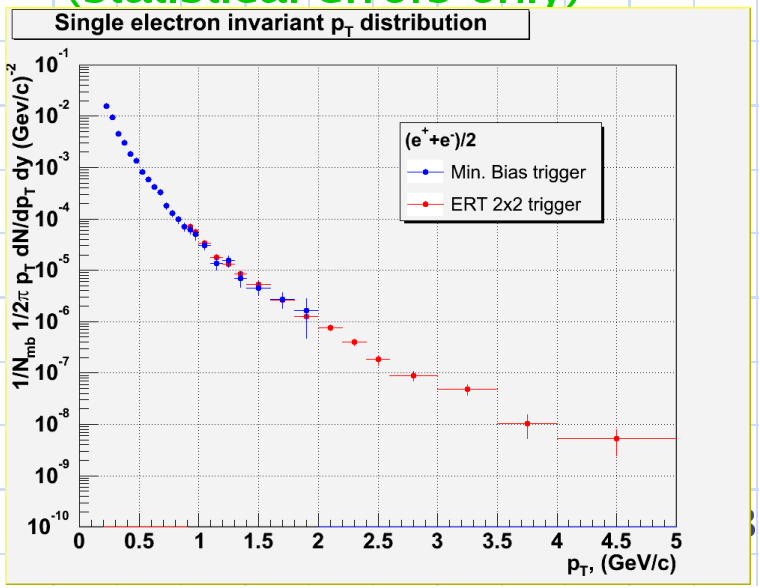


- Trigger efficiency in the stable acceptance region saturates around 95 - 100 % (depending on the EMC sector)

Single electron invariant p_T distribution

- Raw p_T distributions were corrected for:
  - Acceptance
  - Reconstruction efficiencies
  - MB & ERT trigger efficiency
- Corrected inclusive p_T distribution is shown below (statistical errors only)

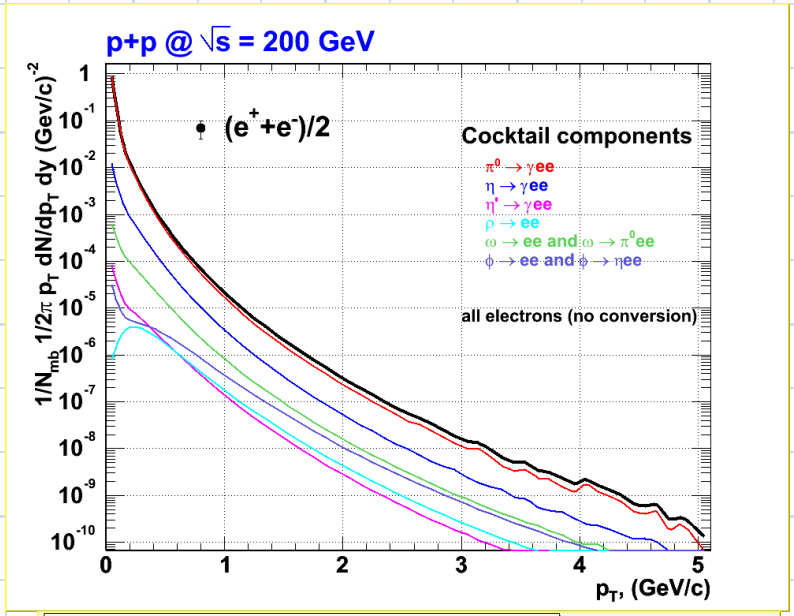


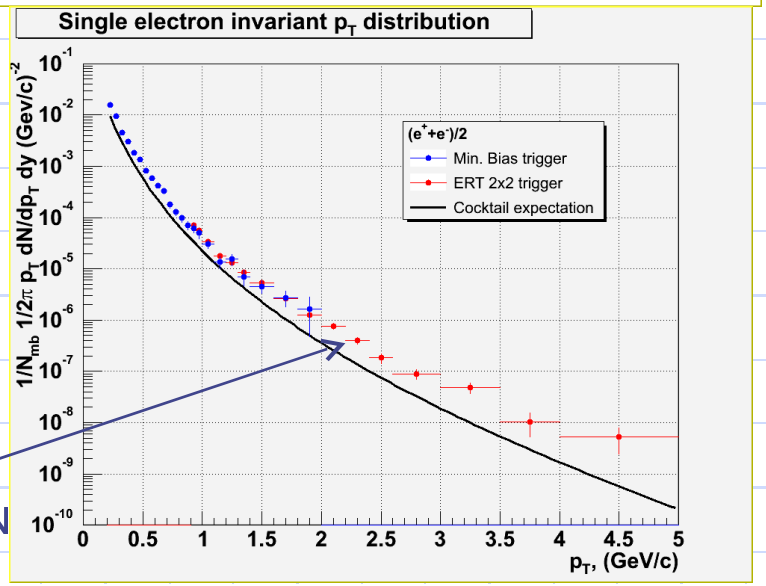


- No significant charge dependance observed
- ERT trigger and Minimum Bias data samples agree with each other at $p_T = 1 \div 2$ GeV/c range

Electron Cocktail comparison

- Cocktail calculations are finished for the hadronic contributors to the spectrum
- Photon conversion component of the Cocktail requires accurate MC simulation of the material in PHENIX acceptance (work in progress)
- Total expected electron yield and contribution from each source is shown on top figure
- Difference between Data and Cocktail is due to **Photon conversions + Heavy Flavor decay electrons**





Summary and Outlook

- Single electron inclusive p_T distribution was measured for p+p Run02 PHENX data up to 5 GeV in p_T
- ERT Level1 trigger results agree with Minimum Bias results
- Electron Cocktail simulation require knowledge of photon conversion probability which is currently being studied
- Much higher statistics of p+p Run03 should significantly improve the accuracy of the measurement