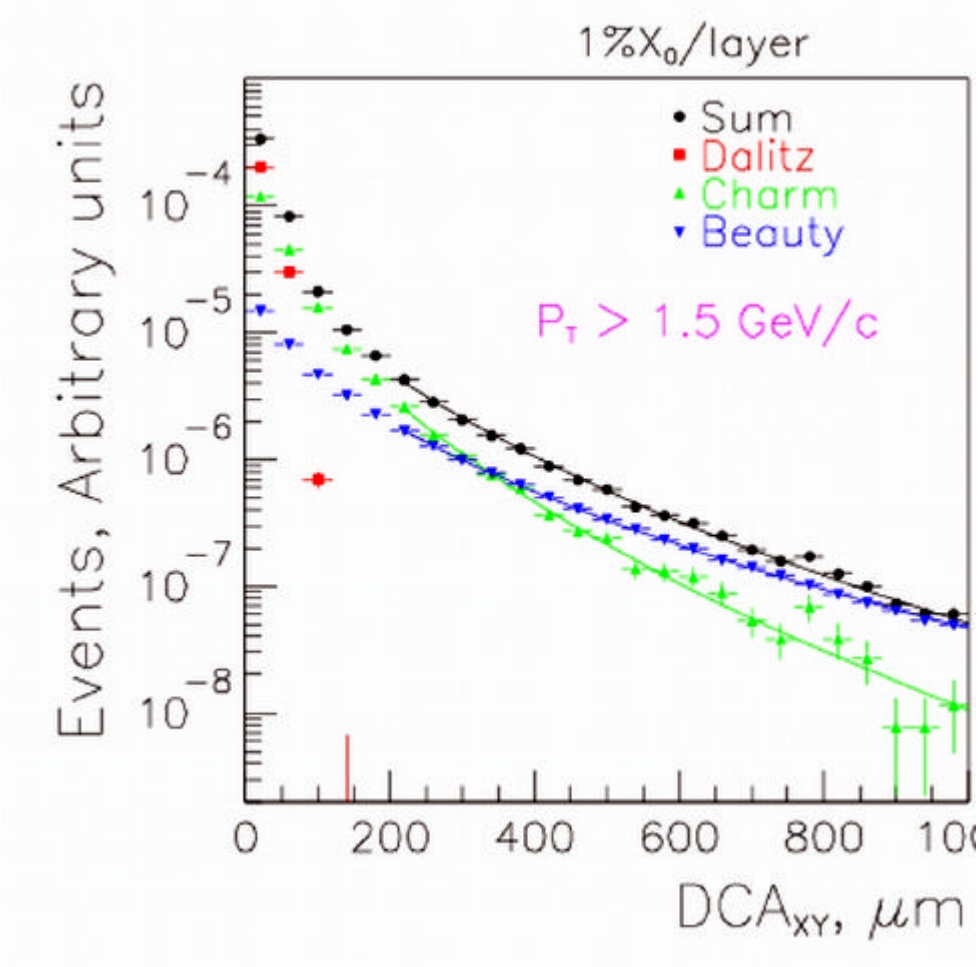
Robust Low-pt Charm D=>eX



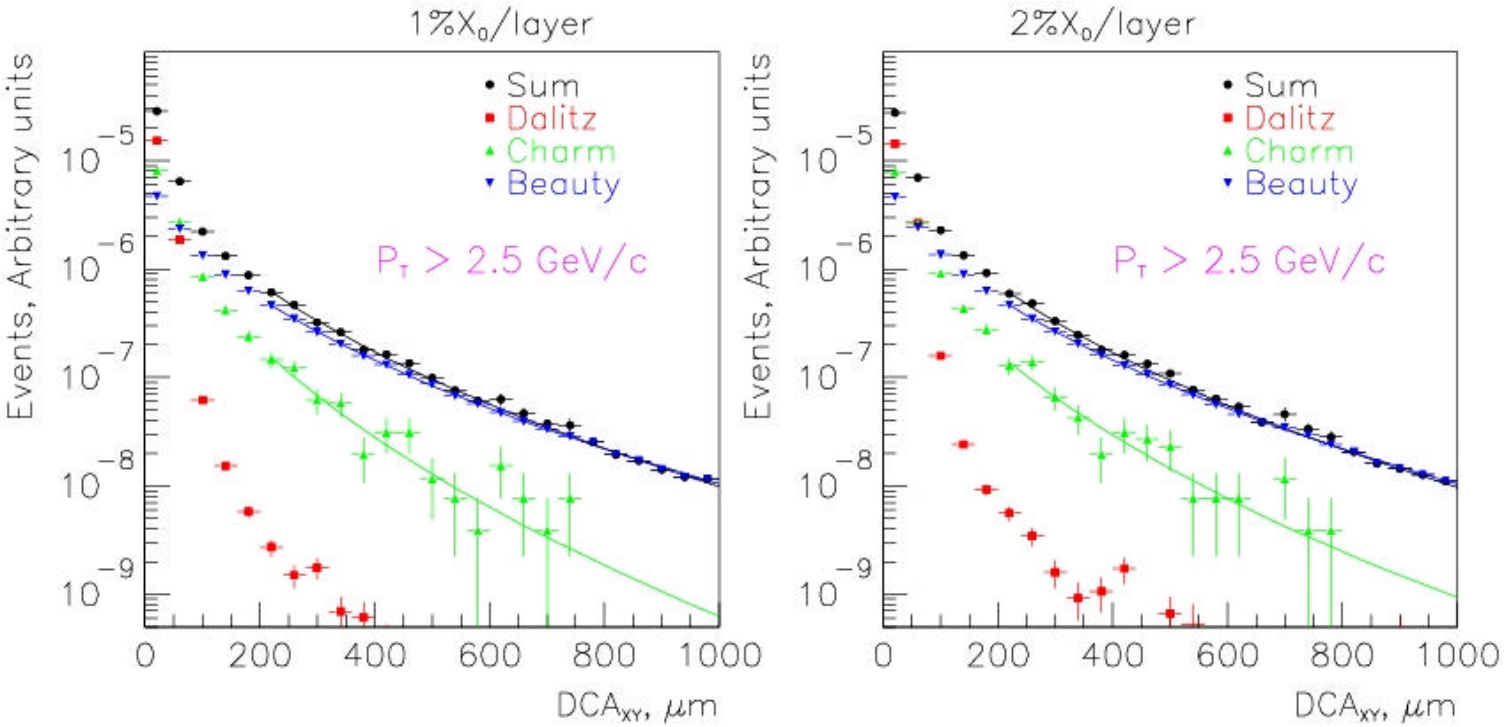
1) remove Dalitz e, DCA cut
2) or fit DCA distribution folded with resolution

⇒ charm yield low pt_D

⇒ reduce systematic error of existing charm result PRL 88:192303,2002

High-pt Charm

- High-pt heavy-quarks may lose less energy in the plasma
  - Kharzeev et al. predict reduced gluon Bremsstrahlung
- High-pt charm not possible via semi-leptonic decay
  - dominated by beauty decays



Open Charm via Specific Channels

- Observe specific D-mesons,
  - $D^0 \Rightarrow K^- \pi^+$ (4%), $D^+ \Rightarrow K^- \pi^+ \pi^+$ (9%), …
  - reconstruct invariant mass of D,
  - extract signal over background etc.
  - measure pt spectra, yields of D^0, D^+, D^-
    - » high-pt helps in multiple-scattering and acceptance
- Problems with simulation in LOI, $D^+ \Rightarrow K^- \pi^+ \pi^+$
  - B=0, straight-line DCA
  - no Phenix acceptance, perfect PID…..
- Summer ’03 (Hua Pei) restart
  - not as much progress as we would like…..

Strategy Options

1) Full B-field in PISA to get π, K, acceptance, decays
   - Kalman tracker using Si hits => DCA
     - » EDA summer '04

★ 2) B=0
   - Fit Si hits with a line, calculate DCA to collision
   - use fast filter to see if π, K in PHENIX acceptance

★ 3) Full B-field in PISA to get π, K, acceptance, decays
   - Fit Si hits with a circle
     - » assumes ~ uniform B-field in vtx region
   - calculate DCA of circular track to collision (c.f. above)

Work Plan (done =✓)

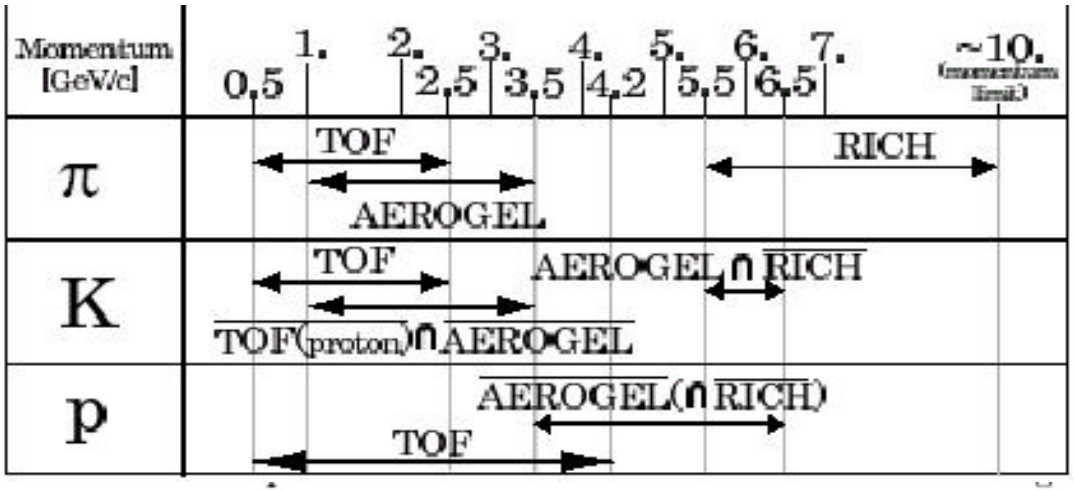
- ✓ <ncoll> * D from pythia, π, K from min.bias Au+Au EXODUS
- ✓ pt > 1 GeV/c on π, K (primary and daughters)
  - selects > 2 GeV/c D's
- ✓ **Kaon** into acceptance of TOF or aerogel
  - goal of PID cut is to reduce S/B
- S/B vs DCA cut
- Use Tony's #events collected in a Au+Au run
  - significance of signal over fluctuating background

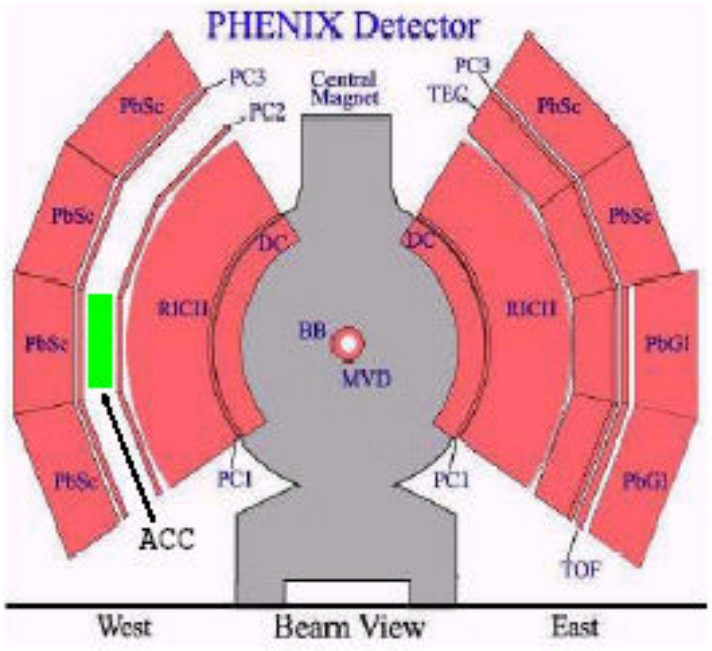
$$\text{significance} = \frac{S}{\sqrt{(s_S)^2 + (s_B)^2}} = \frac{S}{\sqrt{B}}$$

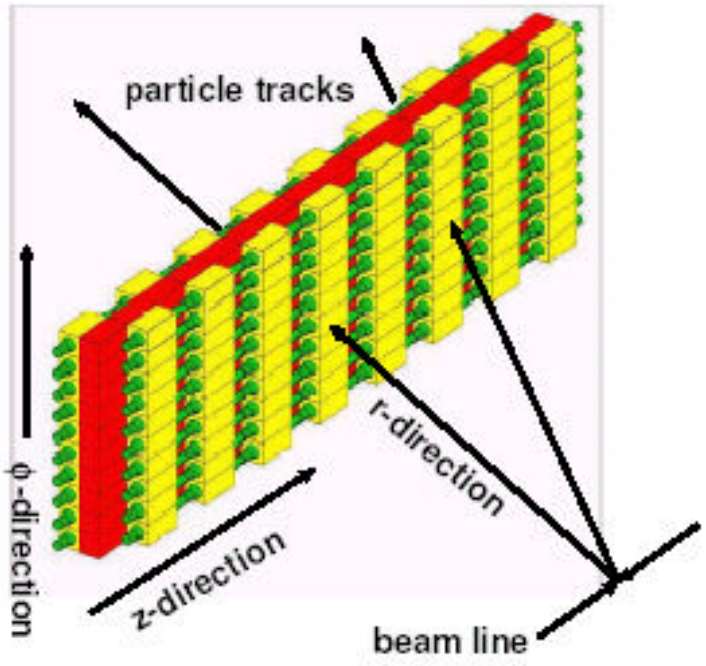
  - increases with sqrt(nevents)
  - plot significance vs DCA cut

backups

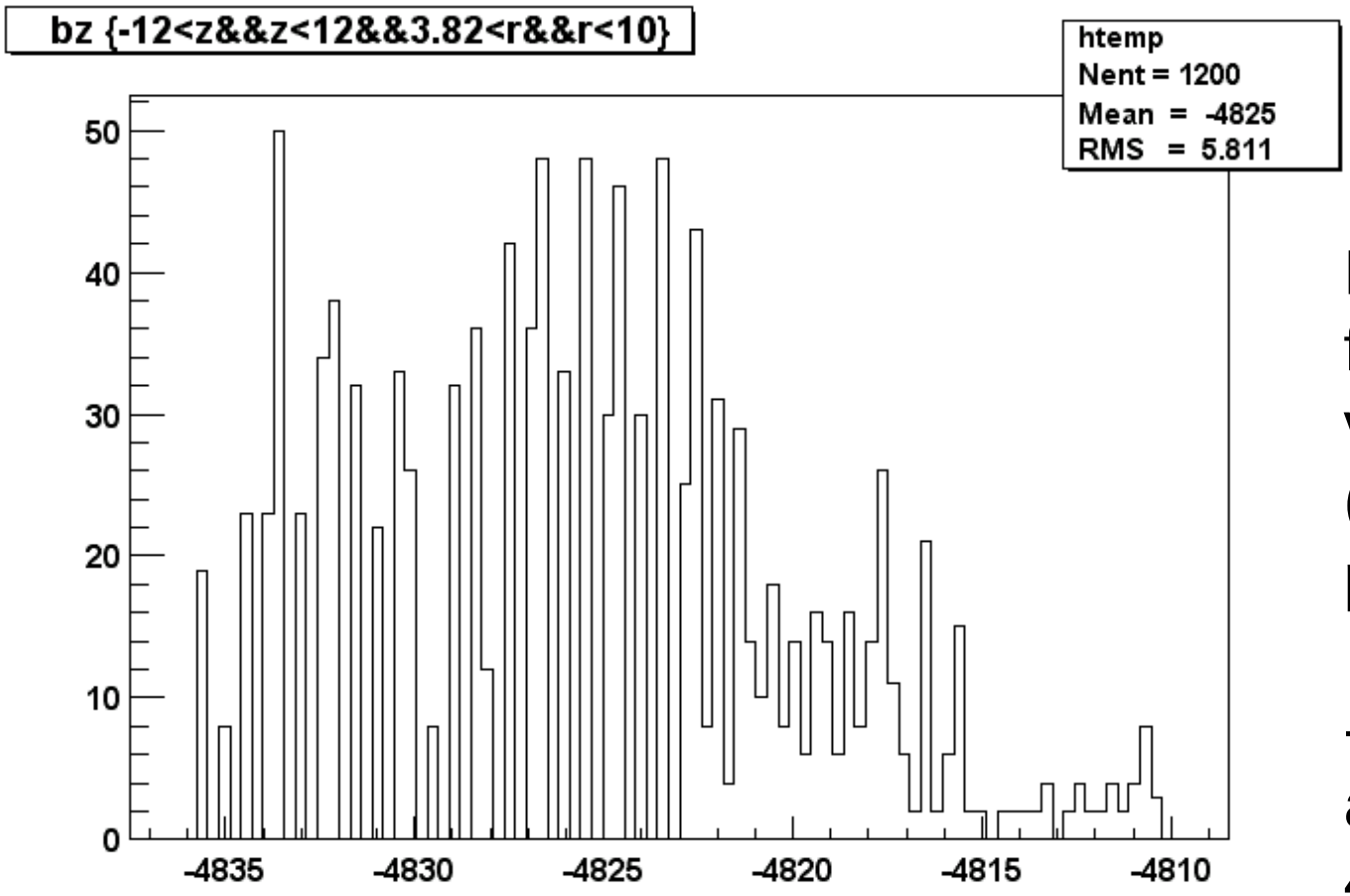
aerogel


Momentum [GeV/c]
0.5
1.
2.
2.5
3.
3.5
4.
4.2
5.
5.5
6.
6.5
7.
~10.
π
TOF
AEROGEL
RICH
K
TOF
AEROGEL ∩ RICH
TOF(proton) ∩ AEROGEL
p
AEROGEL(∩ RICH)
TOF


PHENIX Detector
PC3
Central Magnet
PC3
PC2
TEC
PbSc
PbSc
PbSc
PbSc
PbSc
PbSc
PbGl
PbGl
DC
DC
RICH
RICH
BB
MVD
PC1
PC1
ACC
TOF
West
Beam View
East


particle tracks
φ-direction
r-direction
z-direction
beam line

Bz



Bz values in field map vary < 1% (histogram of points in map)

-12<z<12 and 4 < r < 10 cm

Fitting

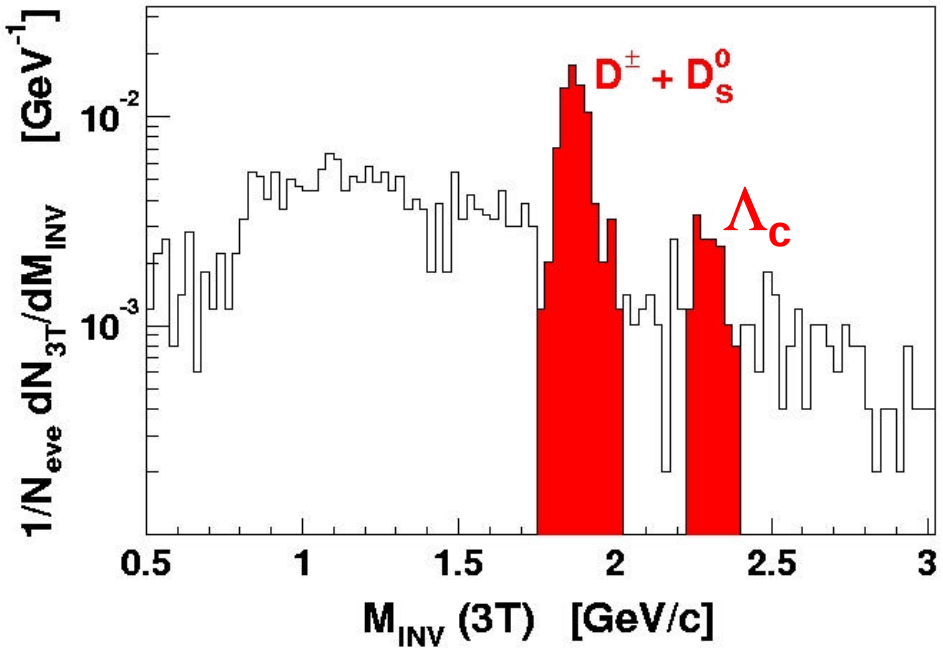
A review of fast **circle** and helix **fitting**

R. Fruhwirth

http://acat02.sinp.msu.ru/presentations/fruehwirth/talk.pdf

High-pt: Flavor Dependence Energy-loss

- @ higher pt, e and μ decay channels dominated by beauty
  - hadronic decay for high-pt charm spectra
    - » multiple-scattering, small acceptance less problematic



$D^+ \Rightarrow K^- \pi^+ \pi^+$ (BR 9%)

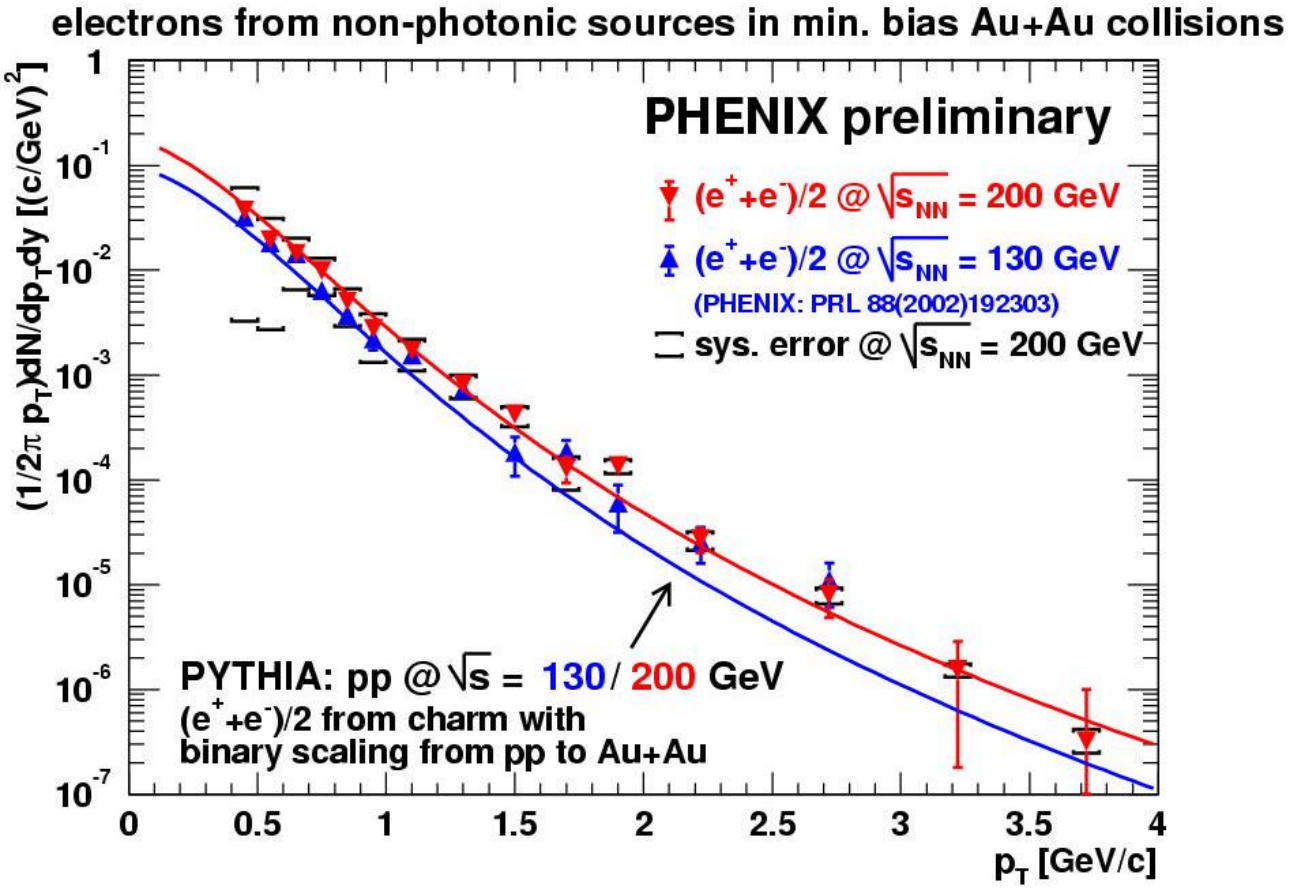
pt >4 GeV/c $D^0 \Rightarrow K\pi$

p+p 30k/year

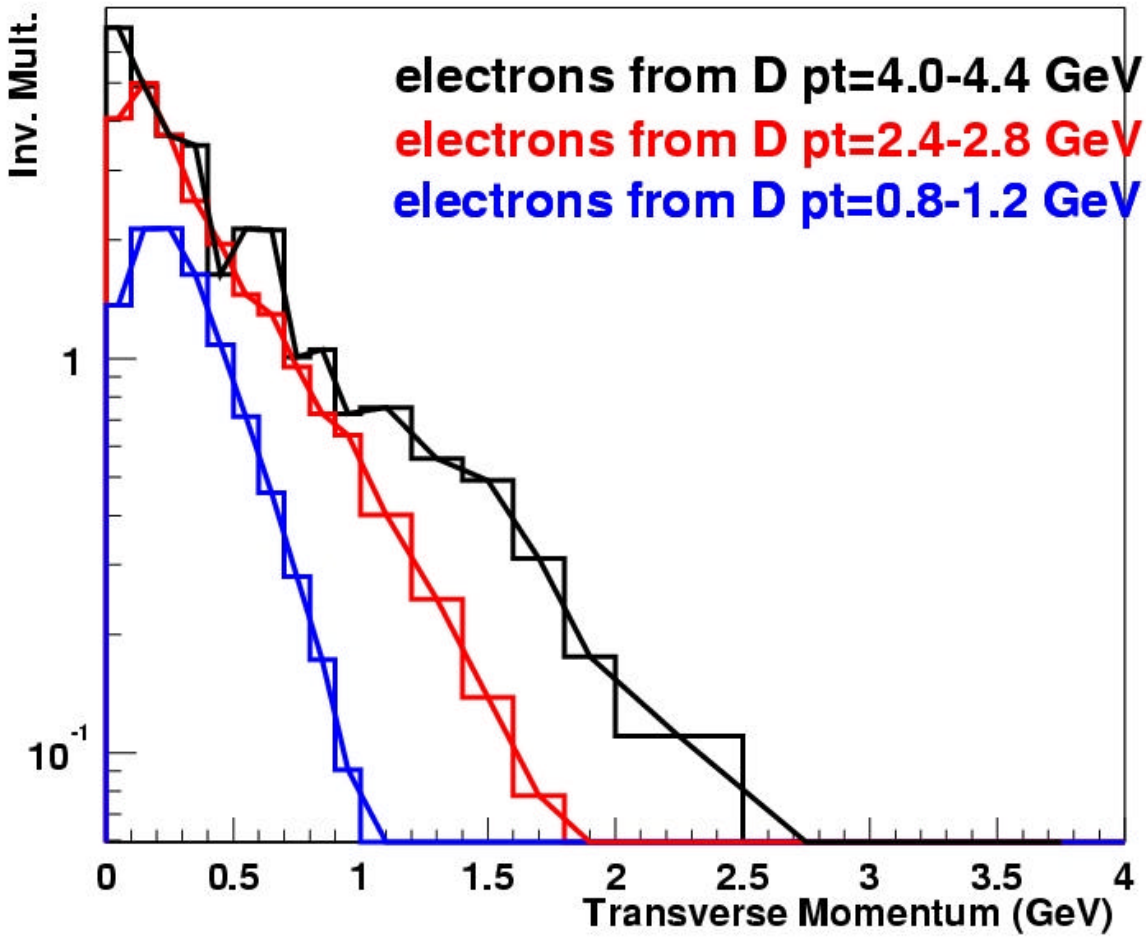
Au+Au 10K/year

Au+Au 4 blue-book luminosity, 50 full days/year, yield Au+Au= AA*(yield p+p)

PHENIX QM02

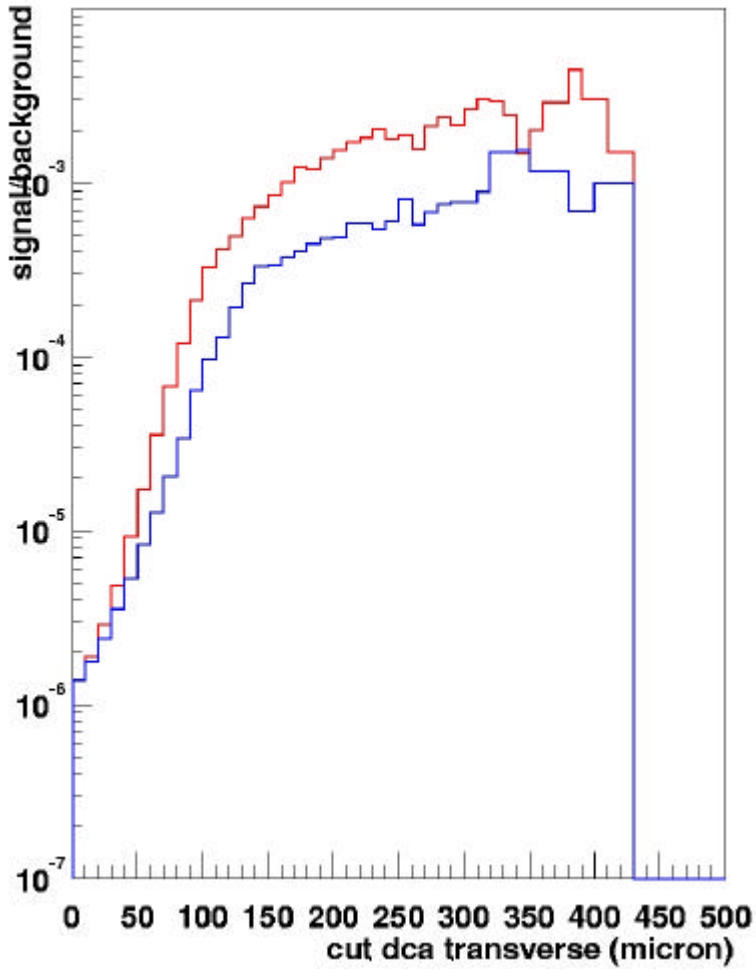

electrons from non-photonic sources in min. bias Au+Au collisions
PHENIX preliminary
(e+ +e-)/2 @ √sNN = 200 GeV
(e+ +e-)/2 @ √sNN = 130 GeV
(PHENIX: PRL 88(2002)192303)
sys. error @ √sNN = 200 GeV
PYTHIA: pp @ √s = 130 / 200 GeV
(e+ +e-)/2 from charm with
binary scaling from pp to Au+Au
(1/2π pT)dN/dpTdy [(c/GeV)2]
pT [GeV/c]

Electron pt Spectra from D



Signal/background of invariant mass peak (2002 plots)

$$\frac{S}{B} = \frac{(D^0 \times \text{Branching Ratio} \times \text{Survive Pt cut})}{(K^- \times \text{Survive Pt cut})(p^+ \times \text{Survive Pt cut})} \times \text{rejection}$$



Kapton beam-pipe

Be beam-pipe

S/B ~ 0.1% for dca cut =150μm

Assumed per event

1 D^0, 150 K^-, 1000 π^+

DCA of K/Pion from D0 comparing with DCA of primary K/Pion (no pt cut)