Prospects of charm measurements at EIC

Zhangbu Xu
BNL
(For BNL eA Group)

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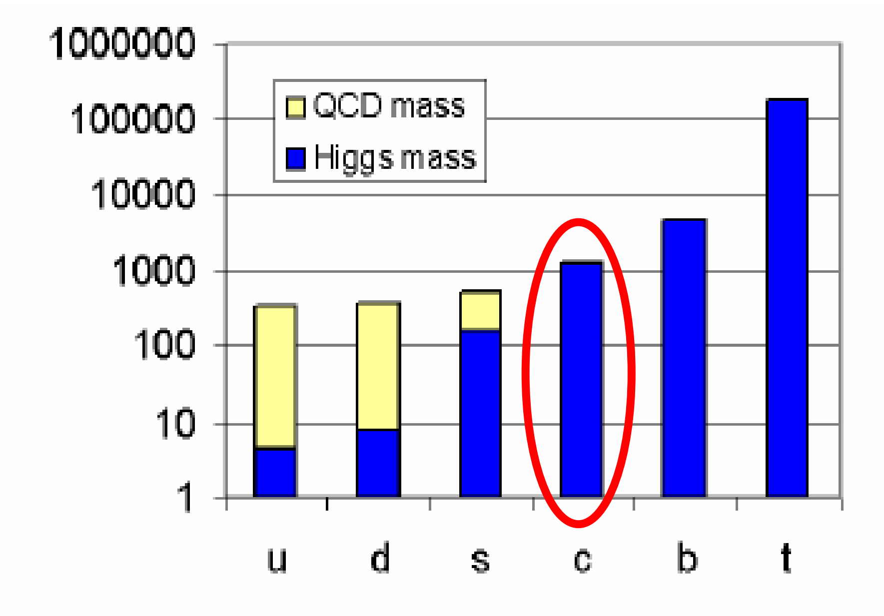
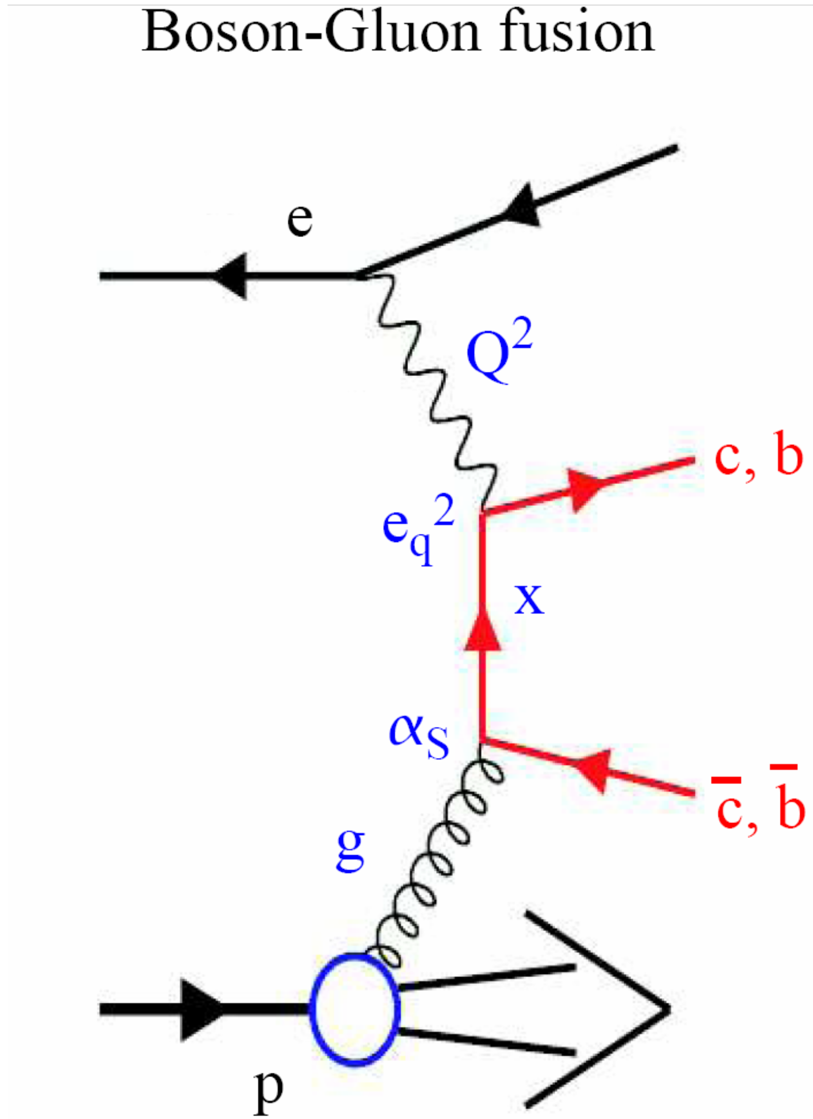
Why Heavy Flavor?

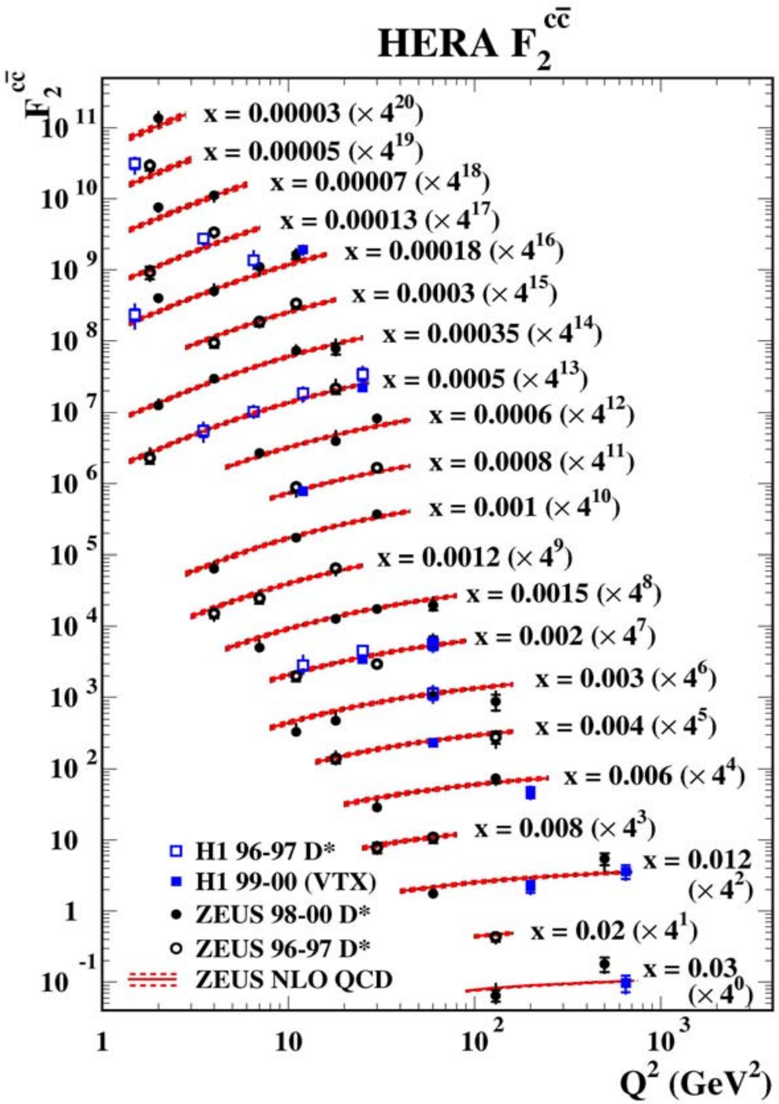


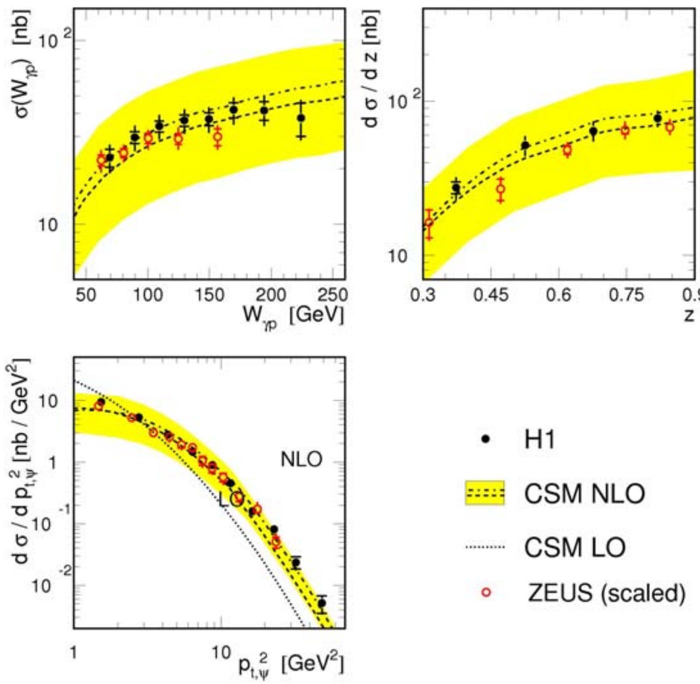
B. Mueller, nucl-th/0404015

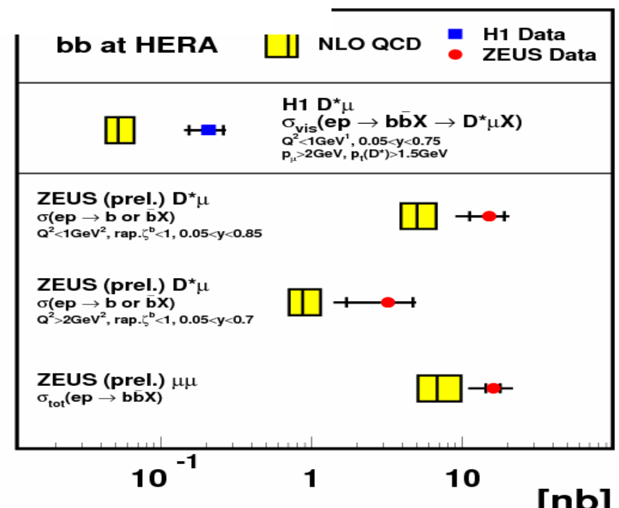


- **Massive quarks**
- **Probe Gluon density**
- **pQCD calculable**

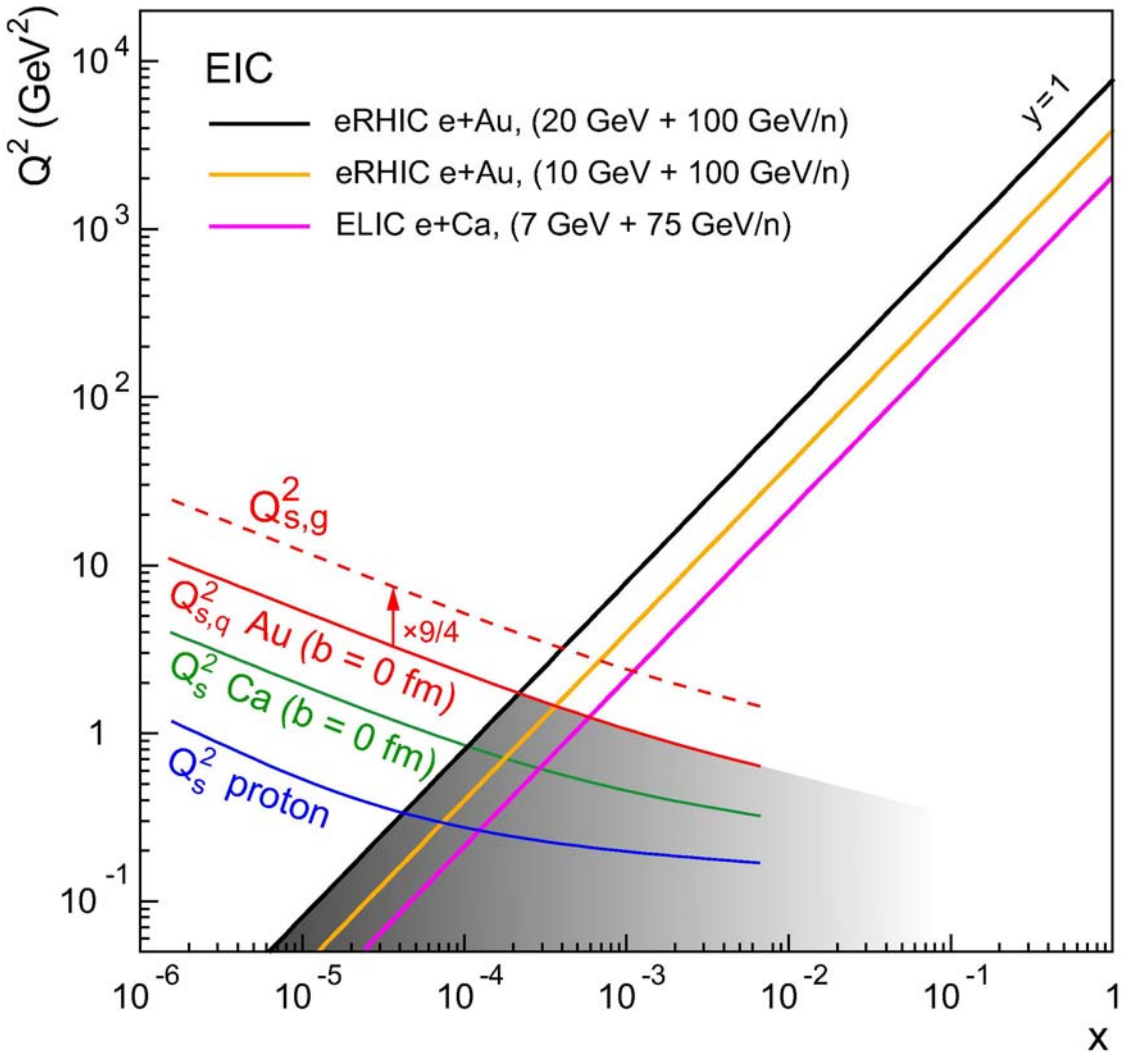
Results from ep at HERA

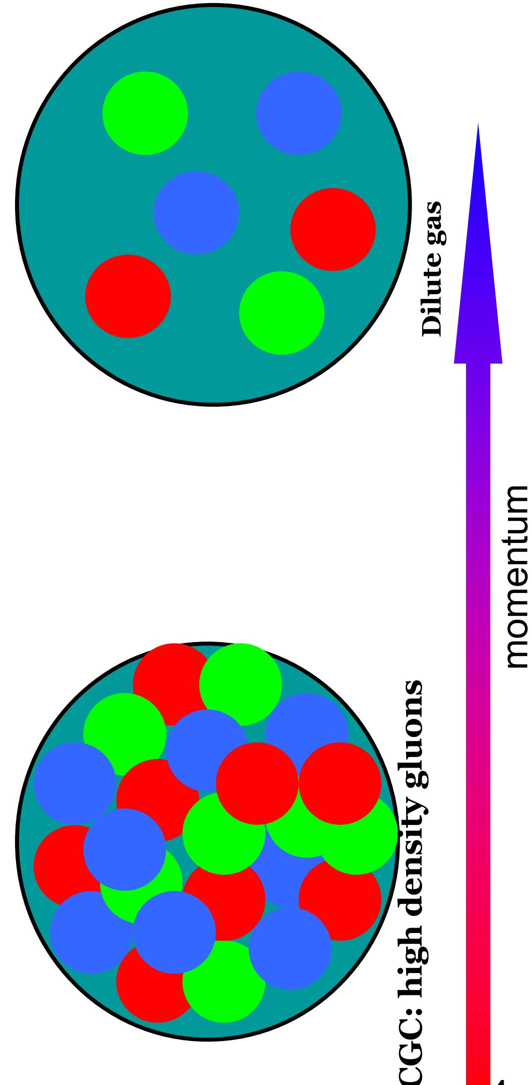




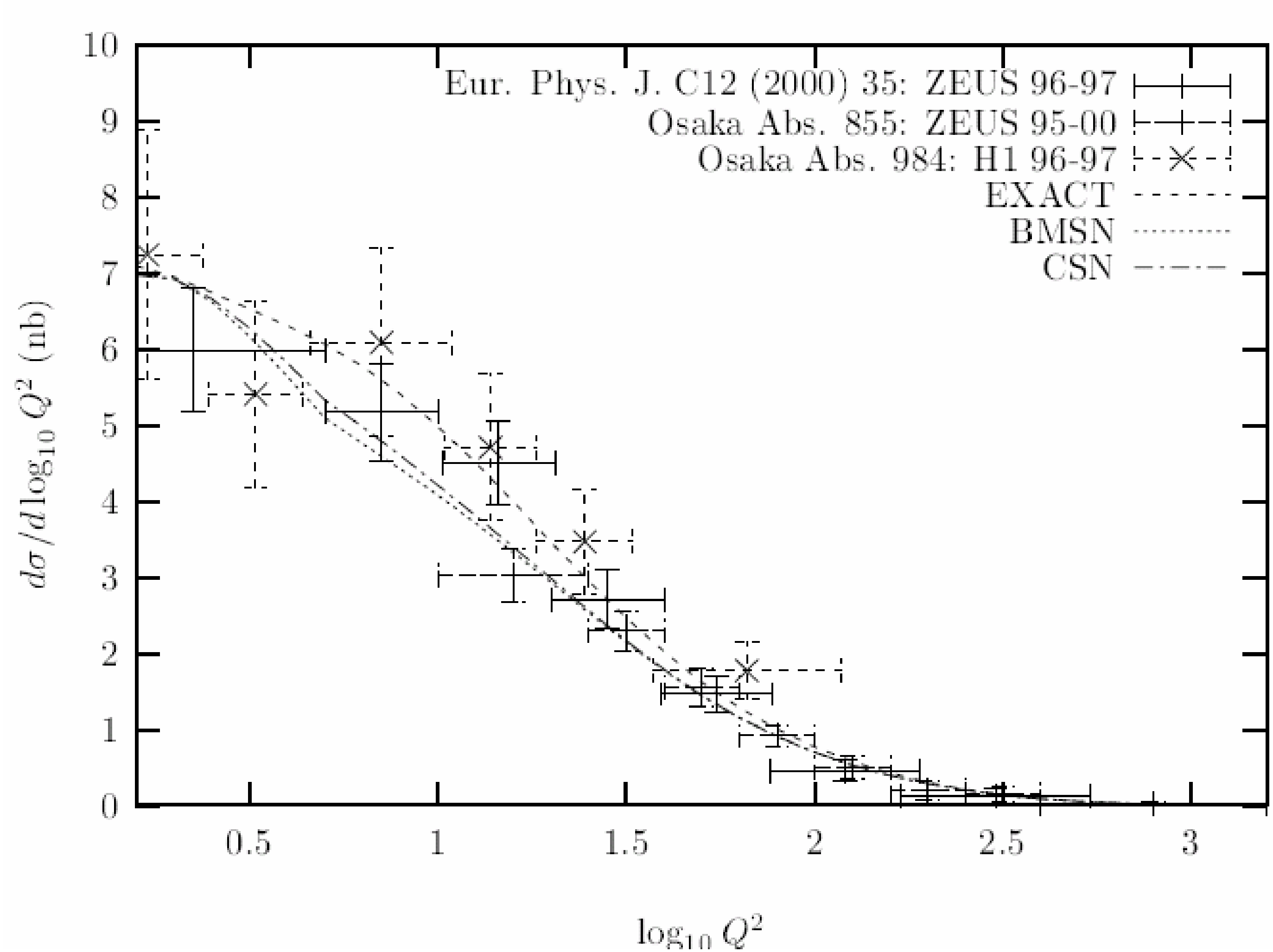


eA (enrich gluons)





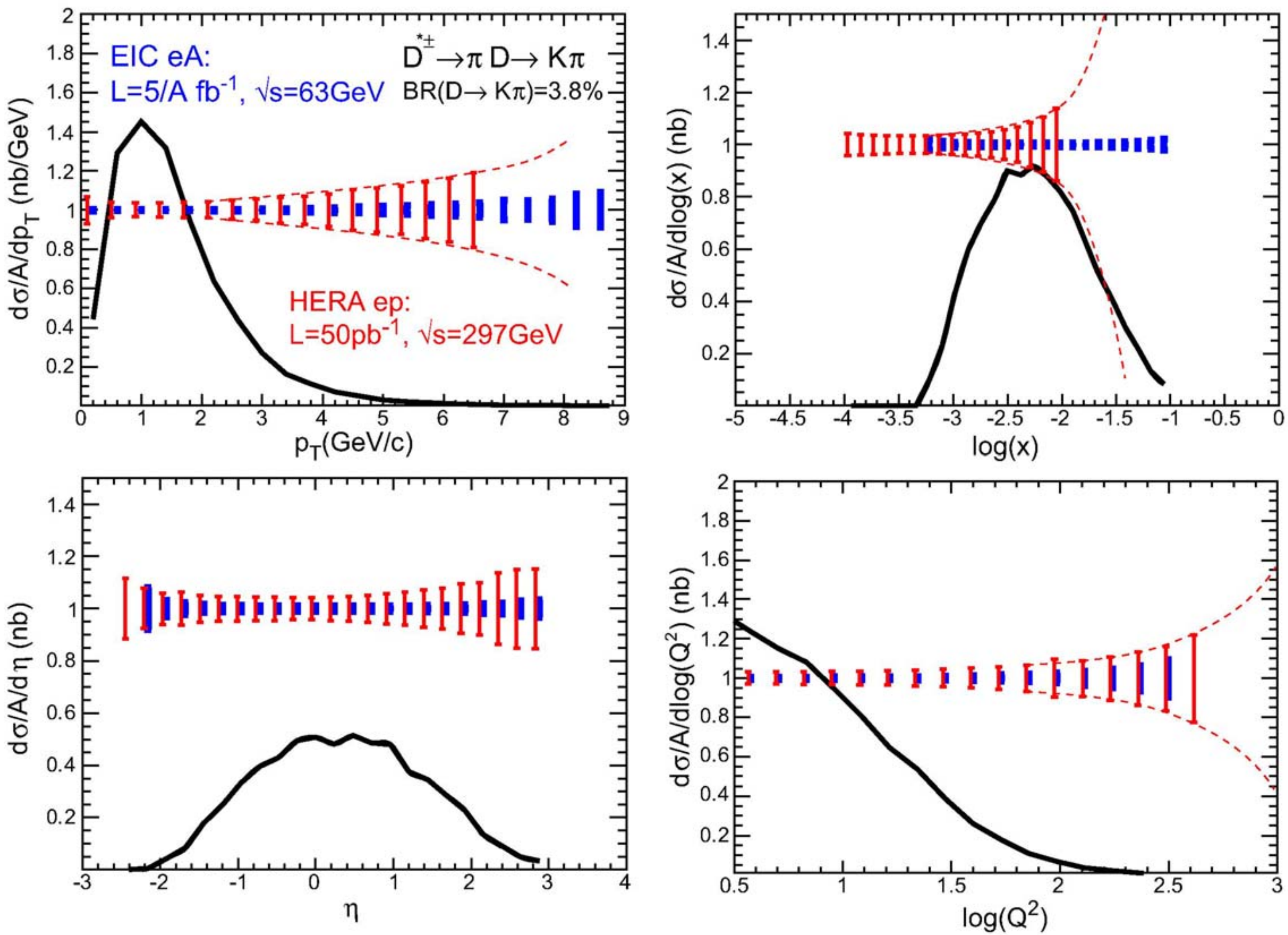
Model used for rate estimates



HVQDIS: different schemes

A. Chuvakin, J. Smith and B.W. Harris, hep-ph/0010350; PRD 57(98)2806

Estimated charm production

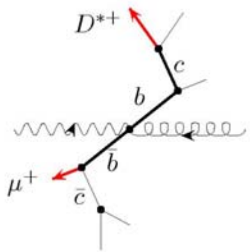
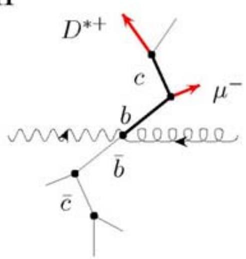
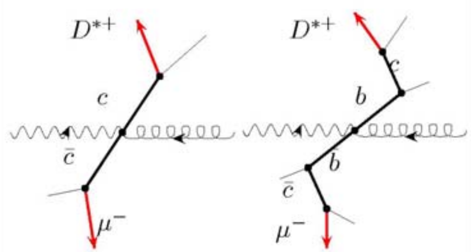


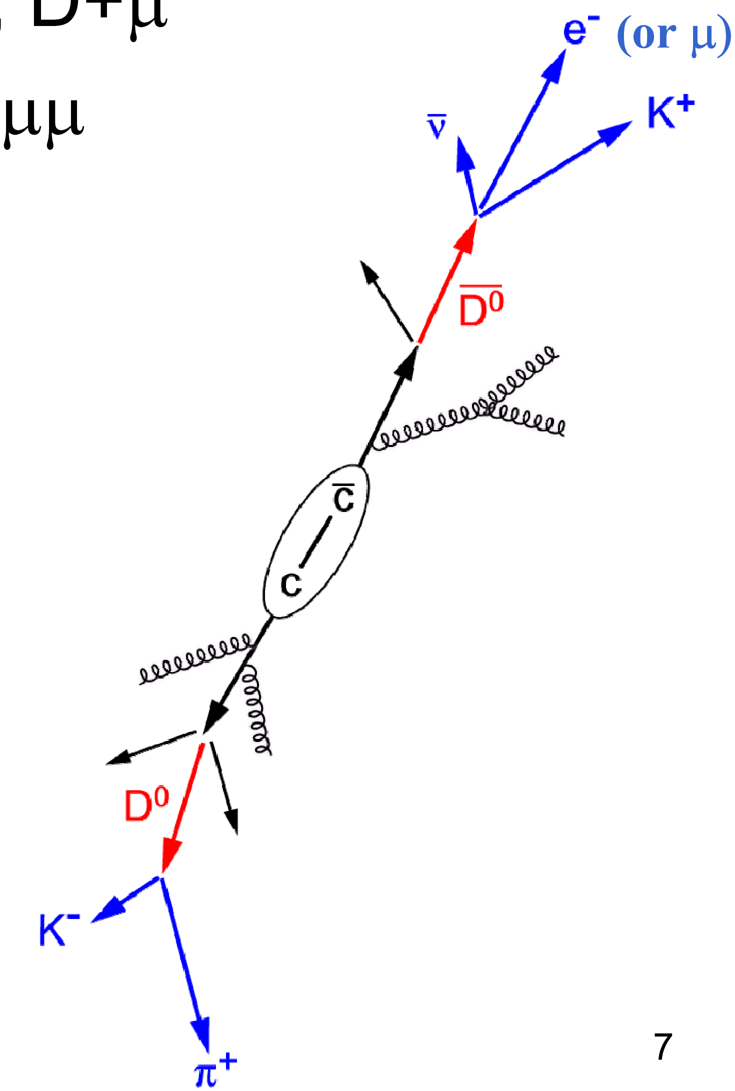
J/psi =~ 1/100 (300) ccbar

Detect heavy Flavors

- D, D*, D+μ
- J/Ψ→μμ

H1, hep-ex/0503038

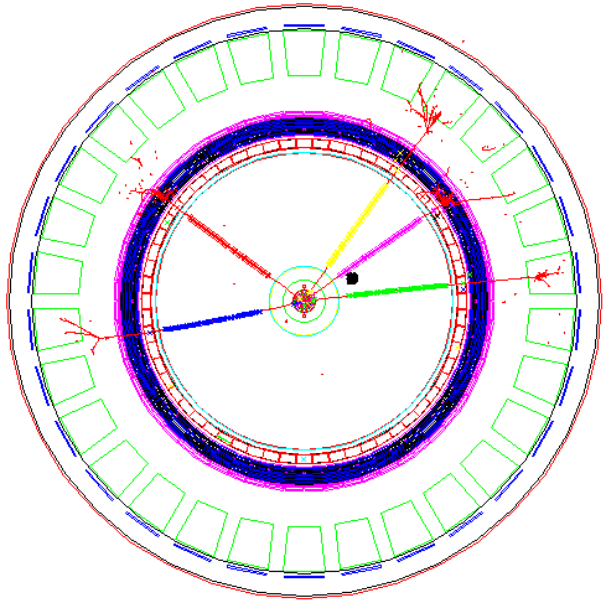
	$\Delta\Phi < 90^\circ$	$\Delta\Phi > 90^\circ$
$Q(D^*) = Q(\mu)$	I	II 
	charm (%) 0.1 beauty (%) 3.8	0.1 20.4
$Q(D^*) \neq Q(\mu)$	III 	IV 
	charm (%) 6.0 beauty (%) 50.0	93.8 25.9

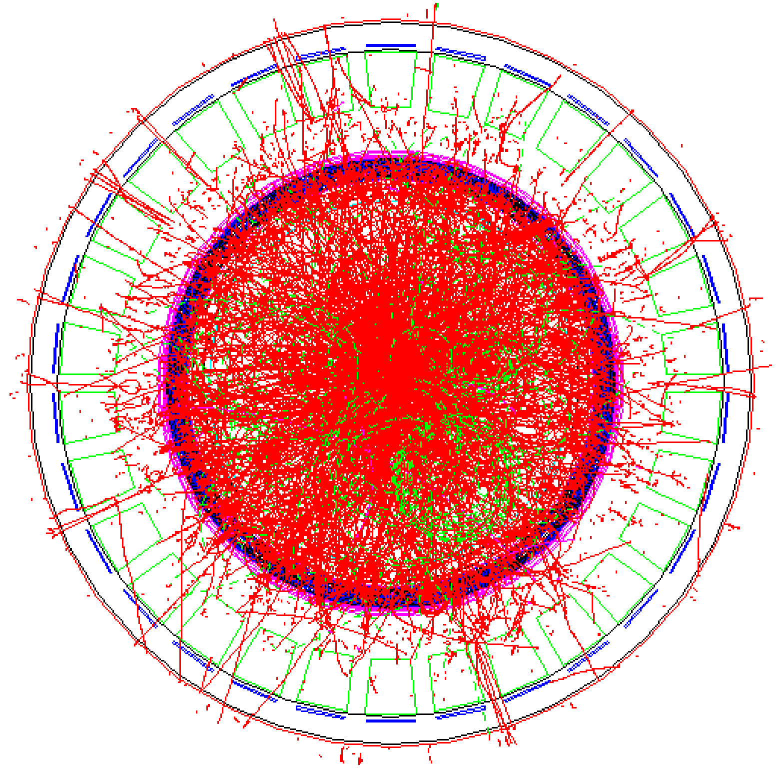


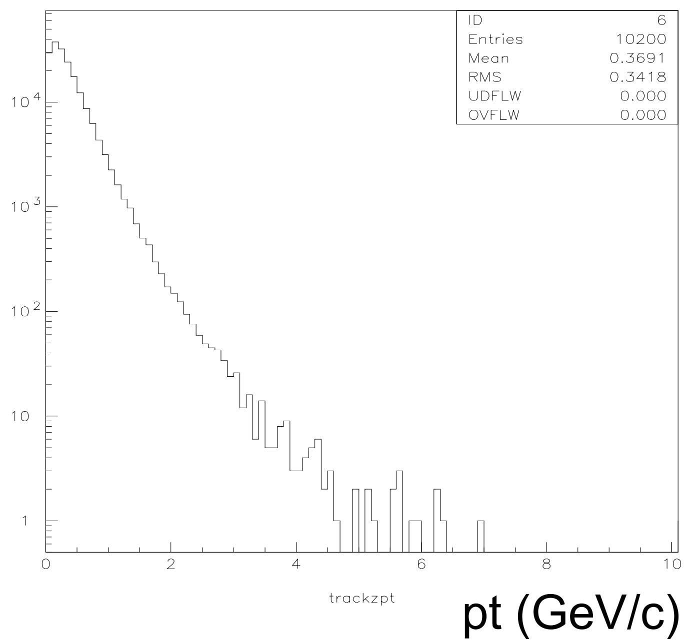
Possible
Compact Muon Detector

- Novel and Compact:
  Timing, Position ↔ Track Segments+FastHits
  One Layer/Detector ↔ Many Detector Systems
  MRPC ↔ RPC+MWPC
- QCDLab:
  Momentum: few GeV/c ↔ 10—1000 GeV/c
  Background tracks: 1000 ↔ 10
- R&D:
  Simulation, MRPC Detector, Online Trigger, Background
- Couple with vertex detector for heavy flavor physics in EIC

Hadron Rejection and Trigger at (e)RHIC

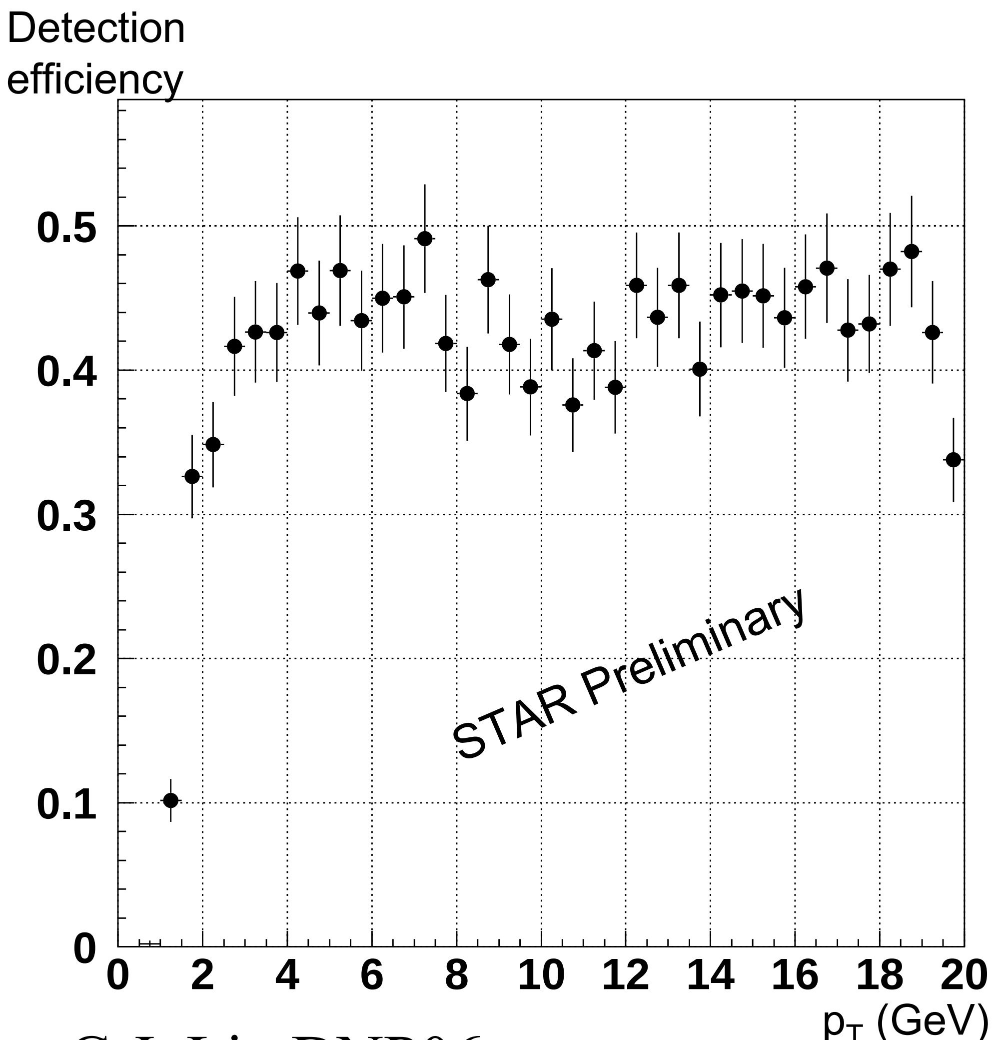






Cuts	Nhit/event
No cut	70
TOF (<20ns)	1.6
Eloss	7.6
TOF&Eloss	0.72
TOF (-400ps,100ps)	0.23

Muon Efficiency



G.J. Lin DNP06

Single particle GEANT simulation.

Particles are generated with flat p_T, η and φ distribution. $0<p_T<20$GeV, 0<η<0.8, 0<φ<2pi.

Cuts used for muon ID:

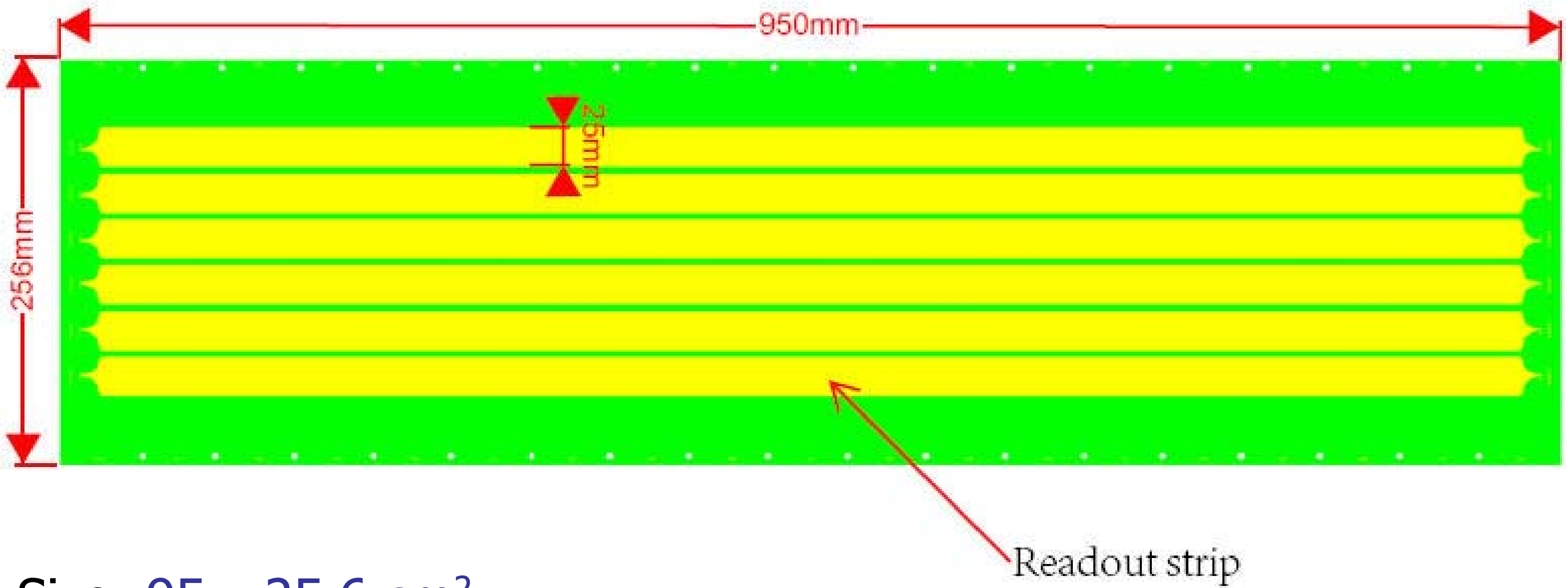
- Time of flight (TOF) difference between hits and tracks.
- Distance of closest approach (DCA) between hits and tracks.

MTD effective azimuthal coverage is 56.6%: ~80% of the muons within MTD coverage can be reconstructed.

Hadron Rejection: ~100

2. LMRPC -- design and construction

TOP View

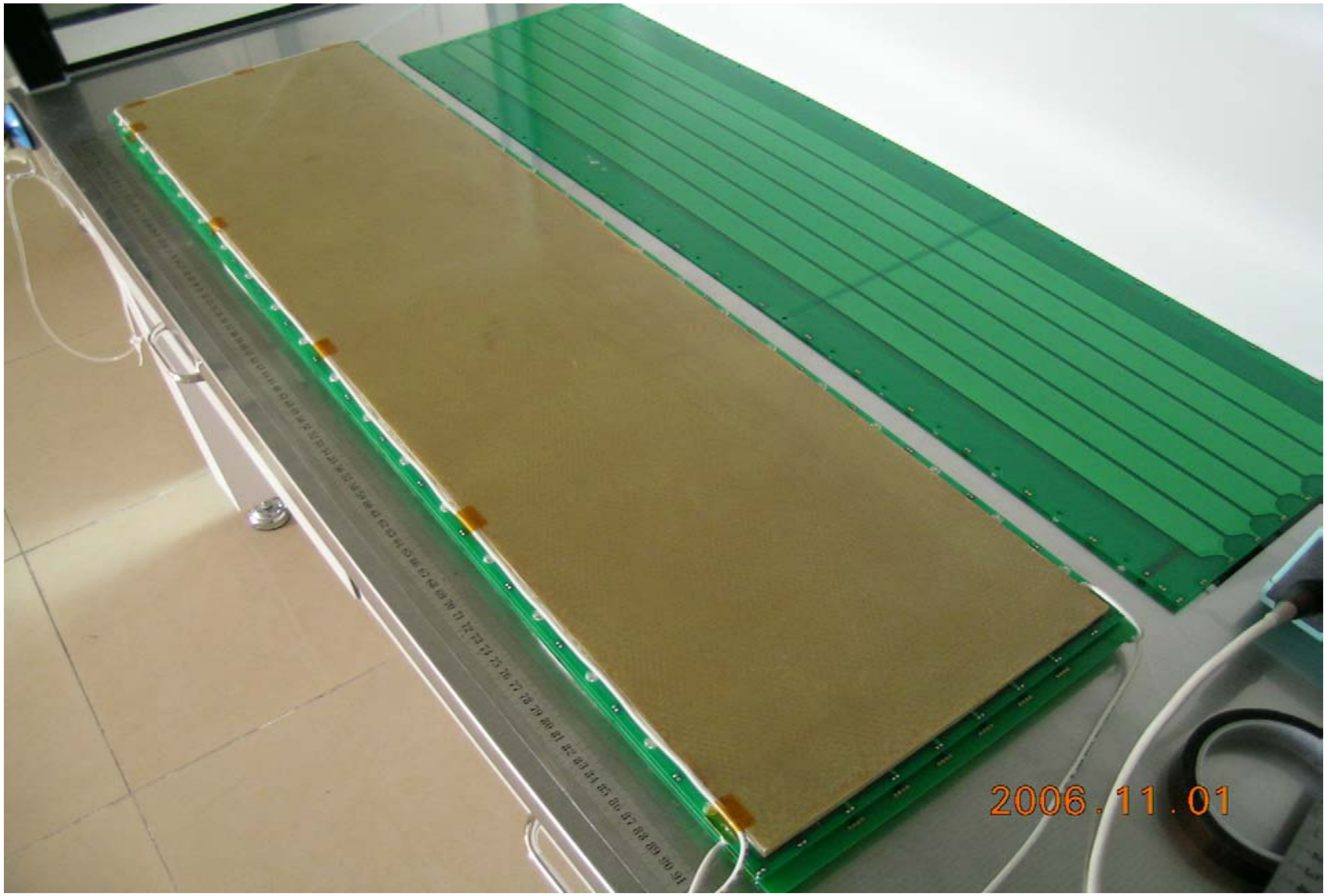


Size: 95 x 25.6 cm^2

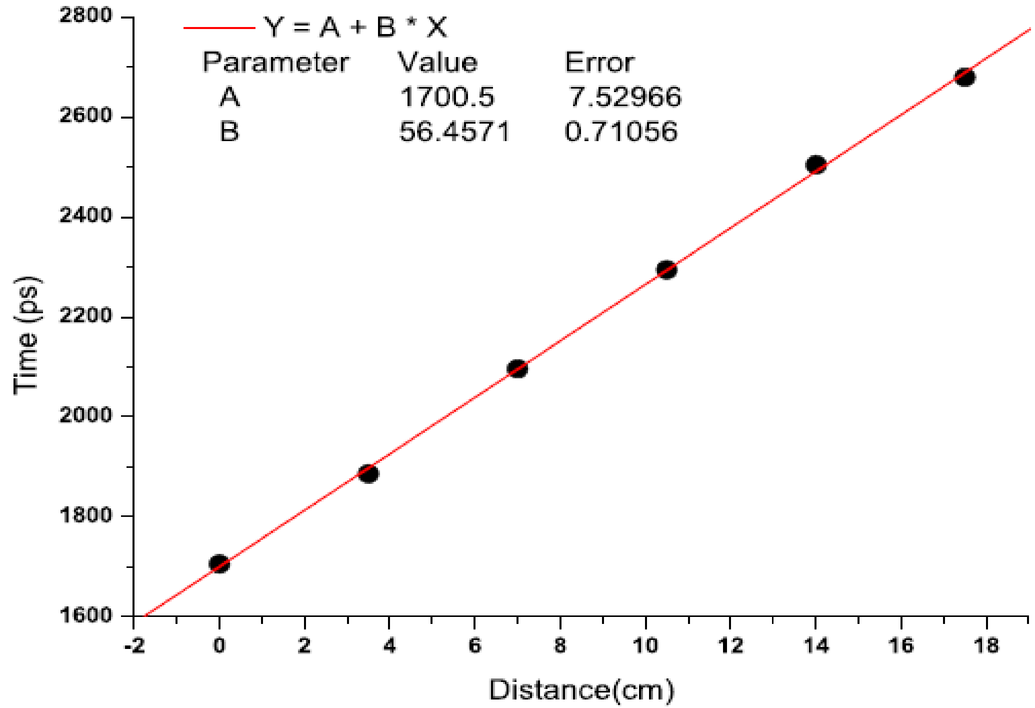
Read out strip: 25 mm wide, 4 mm gaps

Active area: 87 x 20 cm^2

The first LMRPC



Time difference Vs. position



The signal propagation velocity: $56.4 \pm 0.7\, ps / cm$

Time Resolution: 59ps

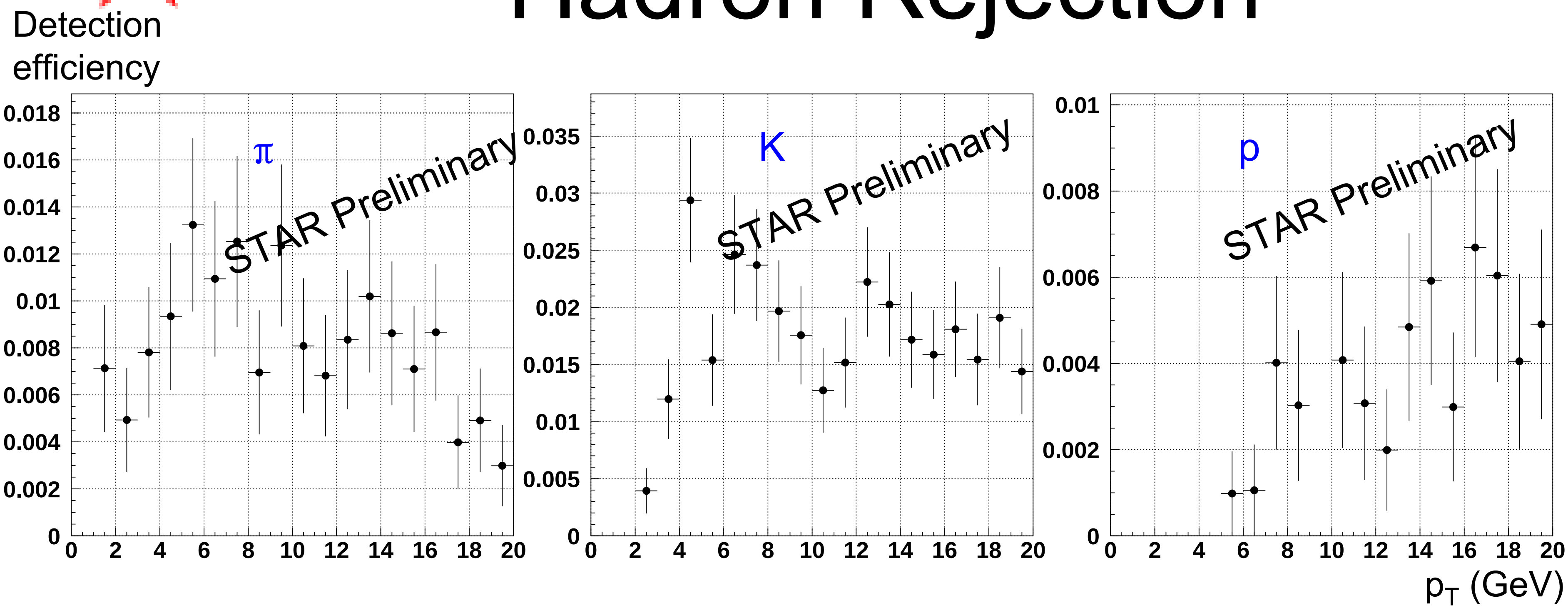
Test Trays at STAR and FNAL MT6

- Test muon/hadron identification at STAR and FNAL test beam
- LMRPC (fast trigger, hadron rejection)
- GEM tracking for improvement of momentum resolution (future)

Conclusions and Prospects

- Future eA with high luminosity
- high statistics with wide kinematics coverage for heavy flavor
- Probe gluon structure in heavy nuclei
- Simulations and detector R&D

Hadron Rejection



MTD is able to reject hadrons by a large factor (50-100) up to high p_T.