

# Heavy Flavor Single Muons at Forward Rapidity in $p+p$ and Cu+Au Collisions



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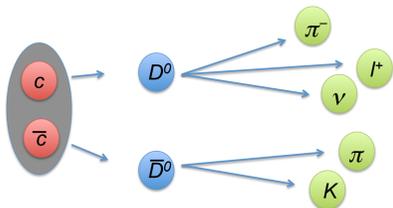
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Heavy flavor is an important probe of QGP in A+A collisions

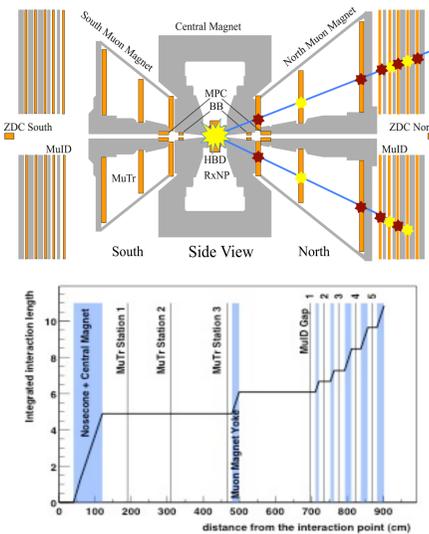
- Produced early in the collision
- Open heavy flavor modification tests the medium coupling strength/energy loss properties
- Heavy quarkonia melting probes the medium temperature

PHENIX is well-suited to measure open heavy flavor in the semi-leptonic decay channels.



PHENIX recorded Cu+Au collisions in 2012 to provide new initial and medium geometries to test.

Cu+Cu, d+Au, and p+p results have been previously published [1,2].



## PHENIX Muon Arms

### Muon Tracker (MUTR)

- Magnetic field to measure momentum
- Absorber in front to reduce hadron flux

### Muon Identifier (MUID)

- Additional steel layers interleaved with layers of larocci tubes to identify muons

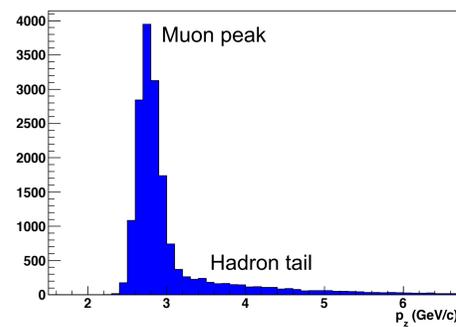
Prior to 2012 data-taking, additional absorber was added in front of the muon arms, further reducing the hadron backgrounds and increasing muon S/B.

Background is estimated via Monte Carlo simulation of a data-driven hadronic ( $\pi, K, p$ ) cocktail

- Cocktail is tuned by matching multiple observables to data.
- Multiple GEANT3 hadronic interaction packages are compared to give systematic uncertainty.

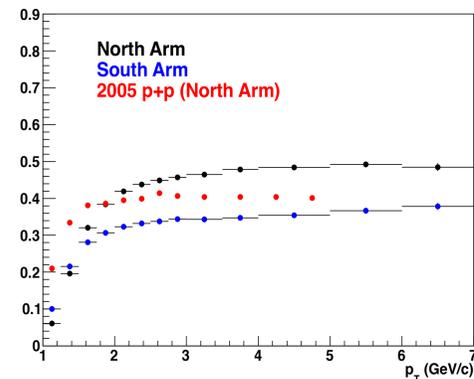


- Match  $z$  distribution of MUID last-gap tracks
- Match flux of hadrons that stop in other MUID gaps
- Remove via geometric / kinematic cuts
- Signal!



The punch-through hadron contribution can be estimated by examining the tracks that stop in the MUID, and selecting those that are in the high  $p_z$  tail. These are primarily hadrons that had a strong interaction in the steel.

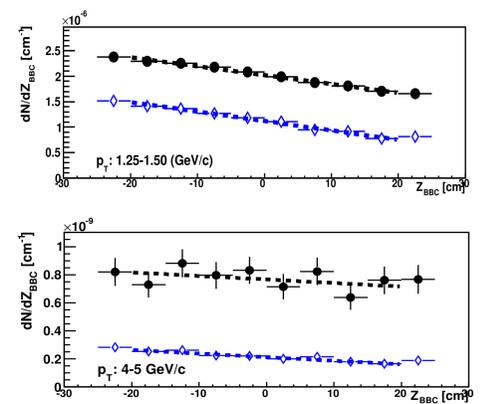
## Acceptance $\times$ Efficiency



The overall acceptance and efficiency for single muons is calculated using the PHENIX GEANT3 simulation package, PISA. Differences between the two arms is primarily caused by variations in the live HV/electronics, as the initial geometries are fairly similar.

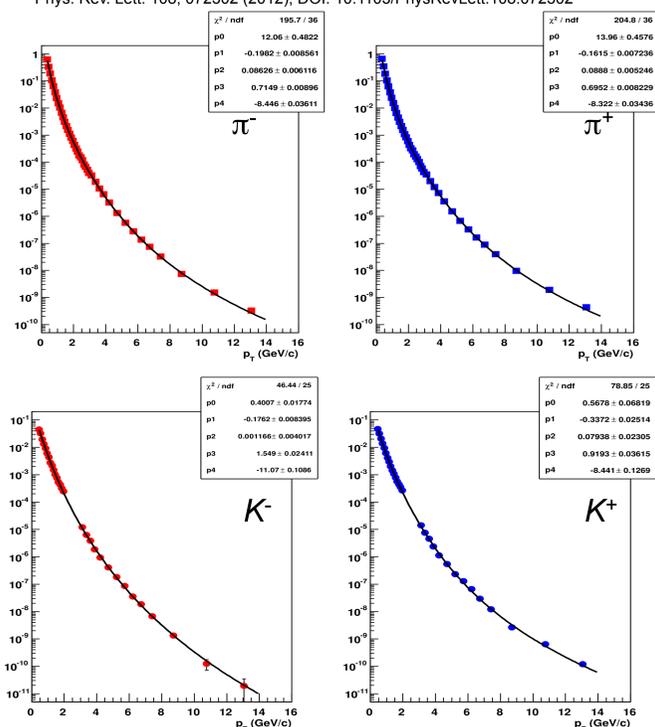
The effect of the additional absorber can be seen at low  $p_T$  in the comparison with the 2005 detector configuration.

The decay muon background is estimated by matching the slope of the decay muon production  $dN/dz$  versus the collision vertex  $z$ -position. This is the primary source of background in this analysis.



$p_T < 3$  GeV/c: A. Adare et al. (PHENIX Collaboration), Phys. Rev. C 83, 064903 (2011), DOI: 10.1103/PhysRevC.83.064903

$p_T > 3$  GeV/c: G. Agakishiev et al. (STAR Collaboration), Phys. Rev. Lett. 108, 072302 (2012), DOI: 10.1103/PhysRevLett.108.072302

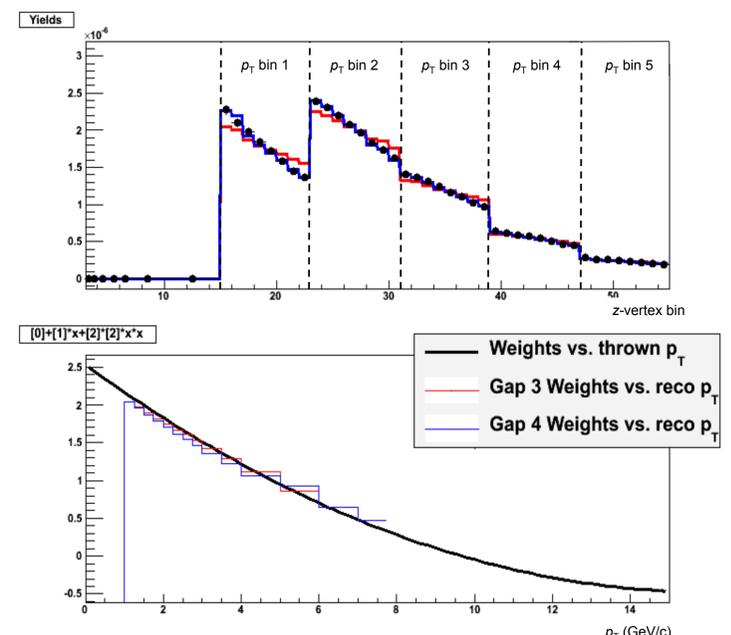


As identified hadron production in the muon arm rapidity range hasn't been measured at RHIC energies, an initial estimate is made using a combination of PHENIX/STAR data at midrapidity and PHOBOS data at forward rapidity.

Then the initial distributions are "tuned" using the matching procedures described above, ie the  $z$  distribution of tracks that completely penetrate the MUID and the size of the hadronic tail in the stopped-tracks distribution.

The tuning procedure was slightly modified in this analysis to use a simultaneous MINUIT fit to the tuning observables. Additionally, the MC information is propagated further into the tuning, allowing for fewer iterations before convergence.

Stay tuned, results are coming soon!



[1] Adare et al., Phys. Rev. C 86, 024909 (2012), arXiv:1204.0754  
[2] Adare et al., arXiv:1310.1005.