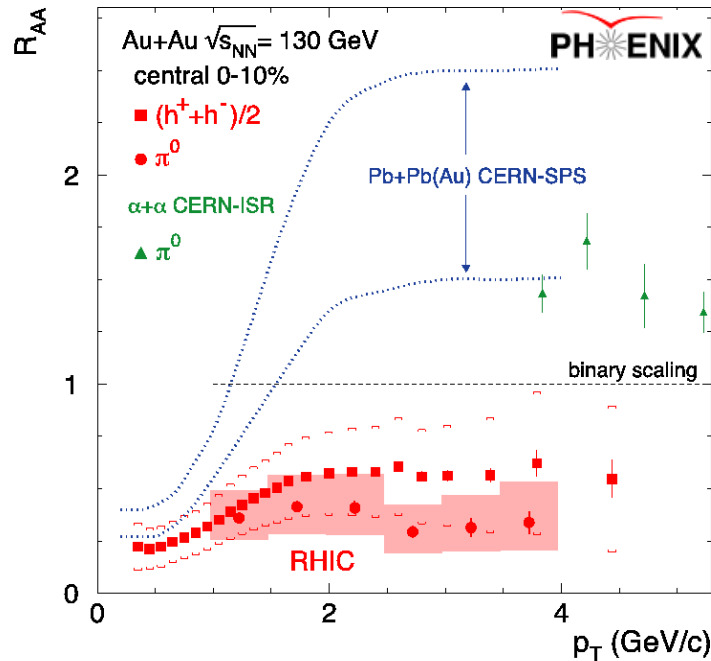


PARTON ENERGY LOSS IN THE QUARK-GLUON PLASMA

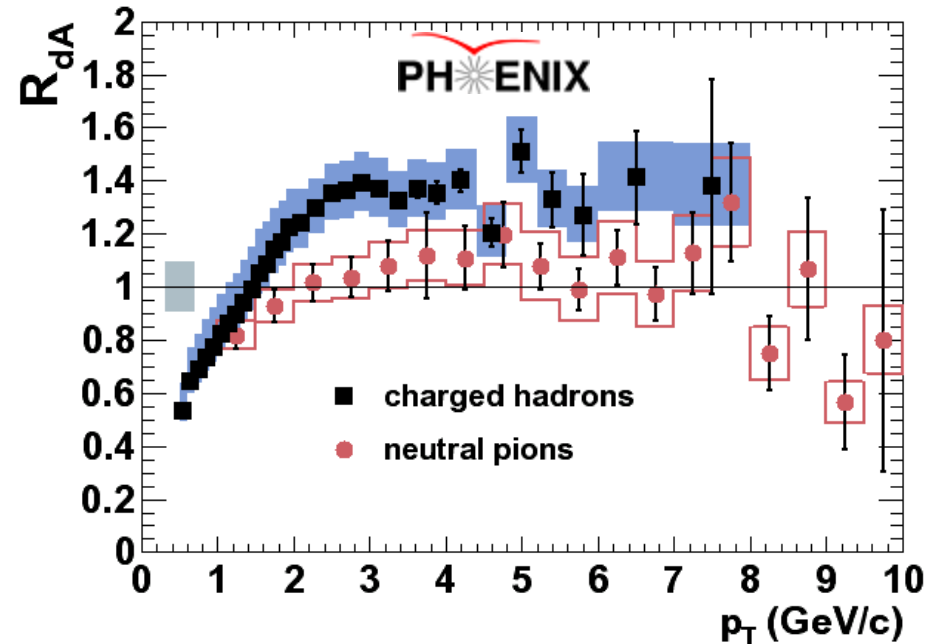
Hard Scattering Results in PHENIX

2



Phys.Rev.Lett. 88, 022301 (2002)

Most cited paper from RHIC
520 citations to date



Phys. Rev. Lett. 91, 072303 (2003)

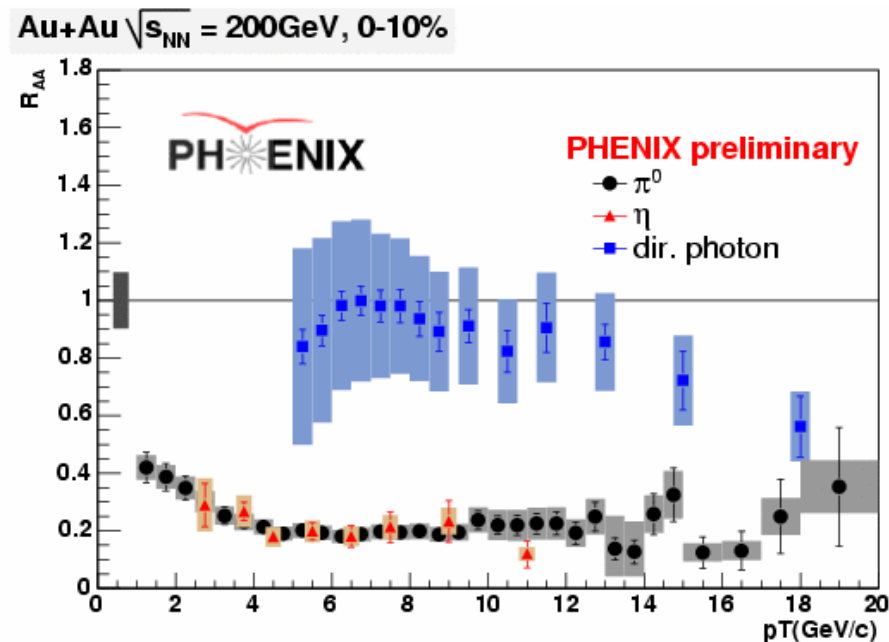
One of six 'famous' PHENIX
papers with > 250 citations

Stefan Bathe RBRC Review 2009



High p_T π^0 And Direct Photons Today

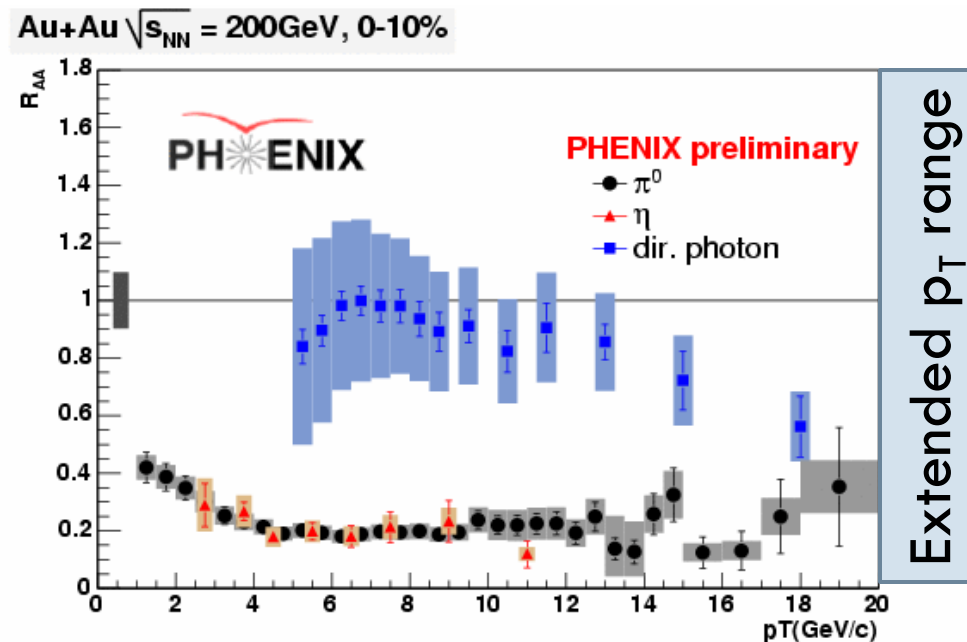
3



- Indication for same R_{AA} for direct γ and π^0 at high p_T
- If true, then no E loss at high p_T
- LHC would have nothing to measure!
- In general interesting to quantify E loss at high p_T

High p_T π^0 And Direct Photons Today

4

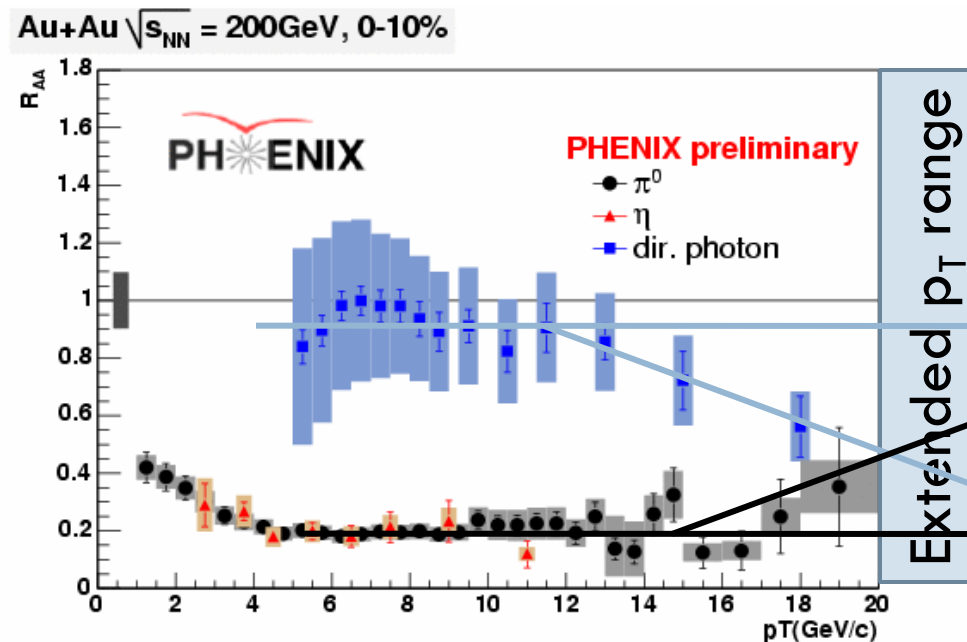


Have high statistics (factor 3) data set (2007)
Also, have
high statistics (factor 30) d+Au data set (2008)

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High p_T π^0 And Direct Photons Today

5

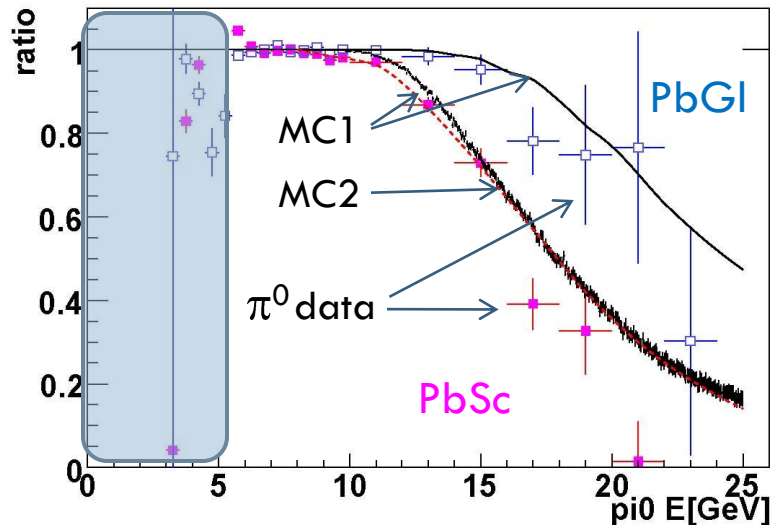


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High p_T π^0 and direct γ : Outlook

6



PHENIX Analysis Note 734

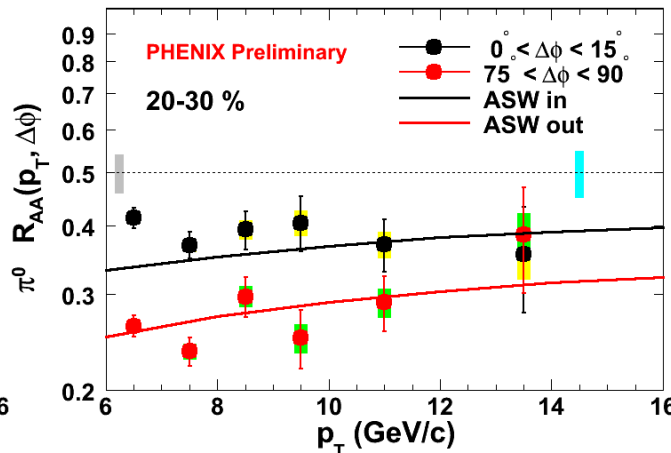
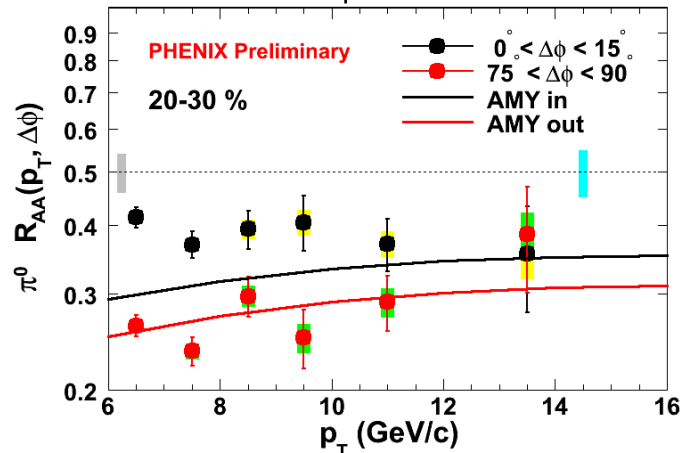
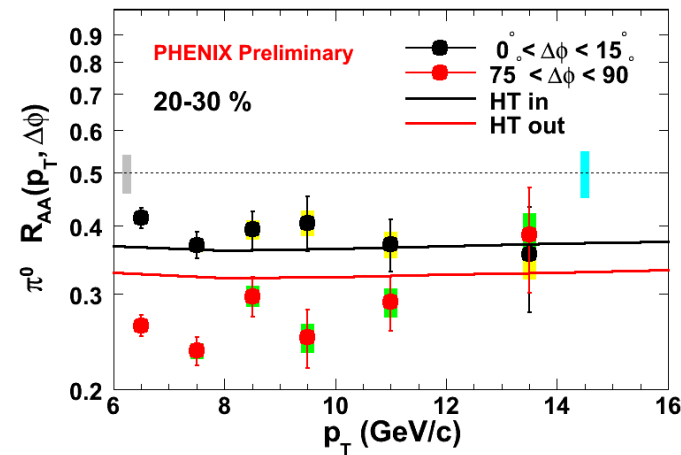
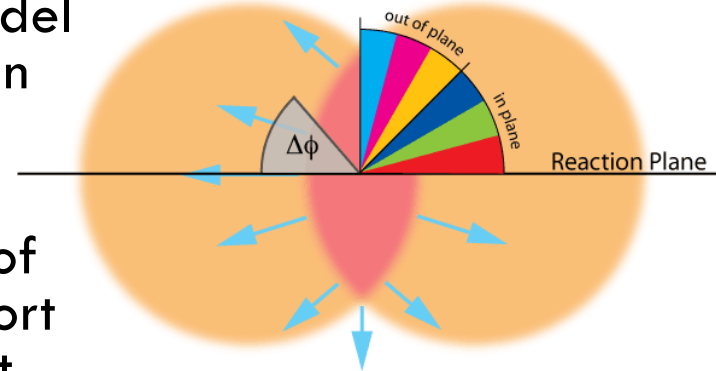
- EMCal calibration has been major preparation work
- Next analysis steps straightforward (largely repeat of previous analyses)
- Understanding merging systematics only challenge
- Simulations and previous studies provide guidance
- Goal: have result in spring 2010

Progress since last year

7

□ Azimuthal anisotropy of RAA

- Provides more differential model comparison than RAA
- Allows determination of medium transport coefficient q that



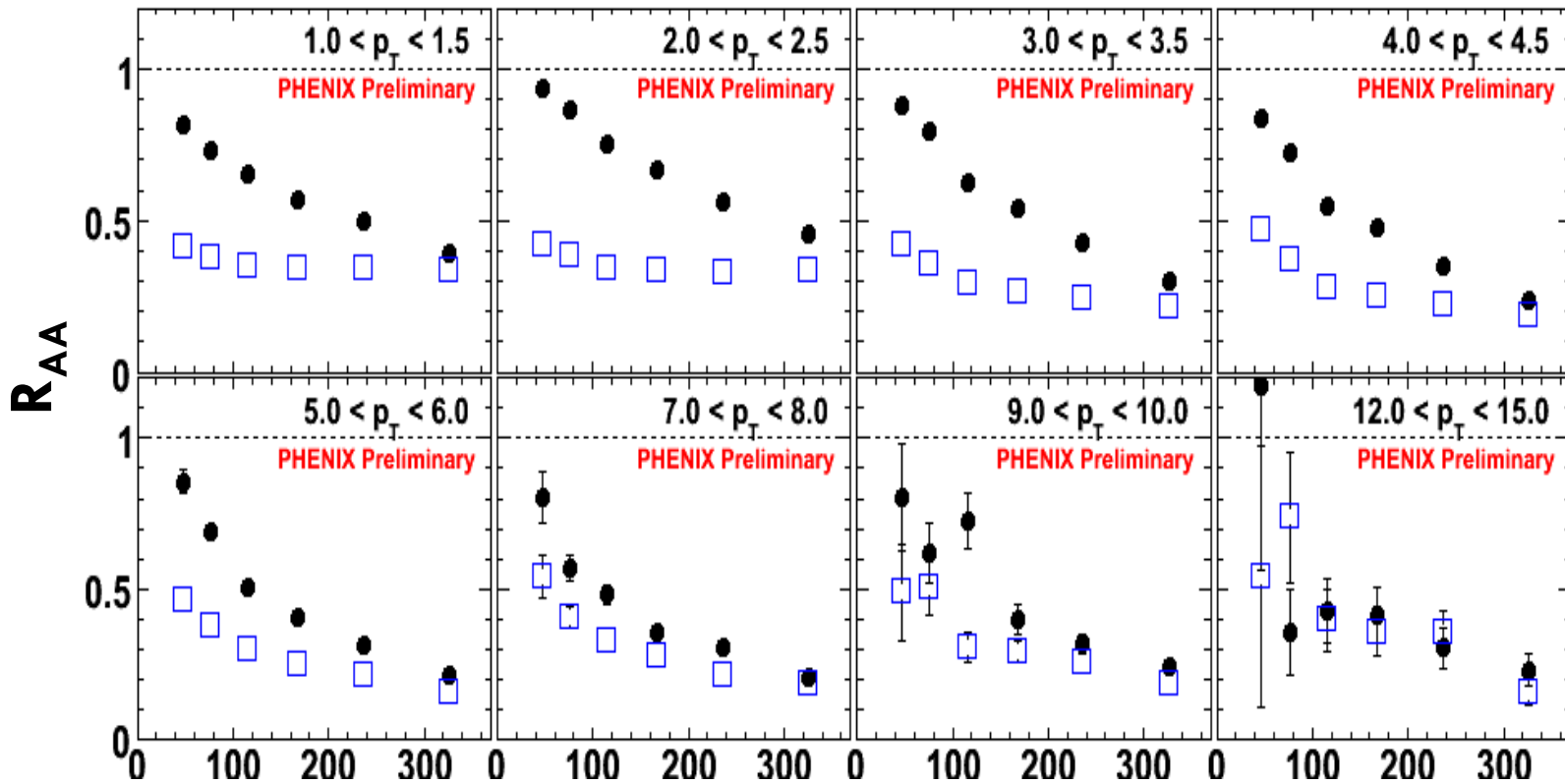
Calculation by S.Bass et al.
arXiv:0808.0908

© Review 2009

Centrality Dependence

8

p_T



□ Indication for saturation of R_{AA} at certain path length

Use η instead of π^0 ?

9

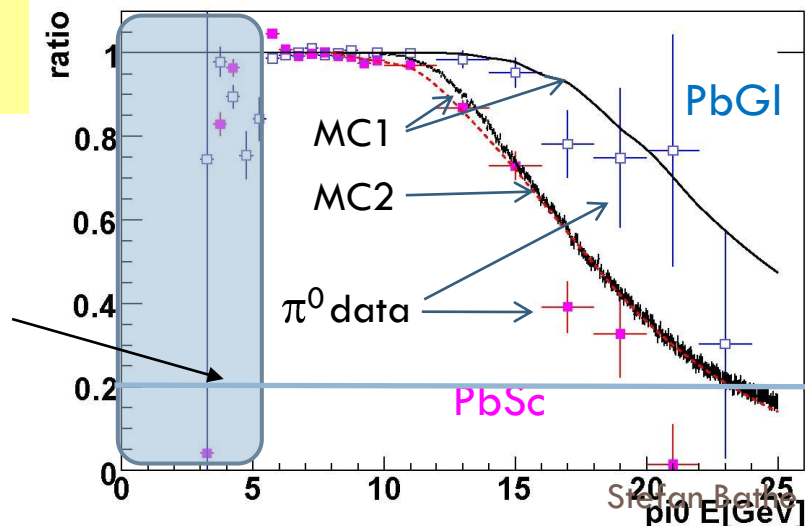
- η
- Mass: $0.5479 \text{ MeV}/c^2$
- $\Gamma(\eta \rightarrow \gamma\gamma) / \Gamma(\eta \rightarrow X)$: 0.393
- Wave function:
 - $(u\bar{u} + d\bar{d})/2 + s\bar{s}$

- π^0
- Mass: $0.1350 \text{ MeV}/c^2$
- $\Gamma(\pi \rightarrow \gamma\gamma) / \Gamma(\pi \rightarrow X)$: 0.988
- Wave function:
 - $(u\bar{u} - d\bar{d})/\sqrt{2}$

$\eta/\pi^0 = \sim 0.5$ (measured at high p_T)

Probability of
detecting two γ 's
from π^0

η probability
 $0.393 \times 0.5 = 0.1965$



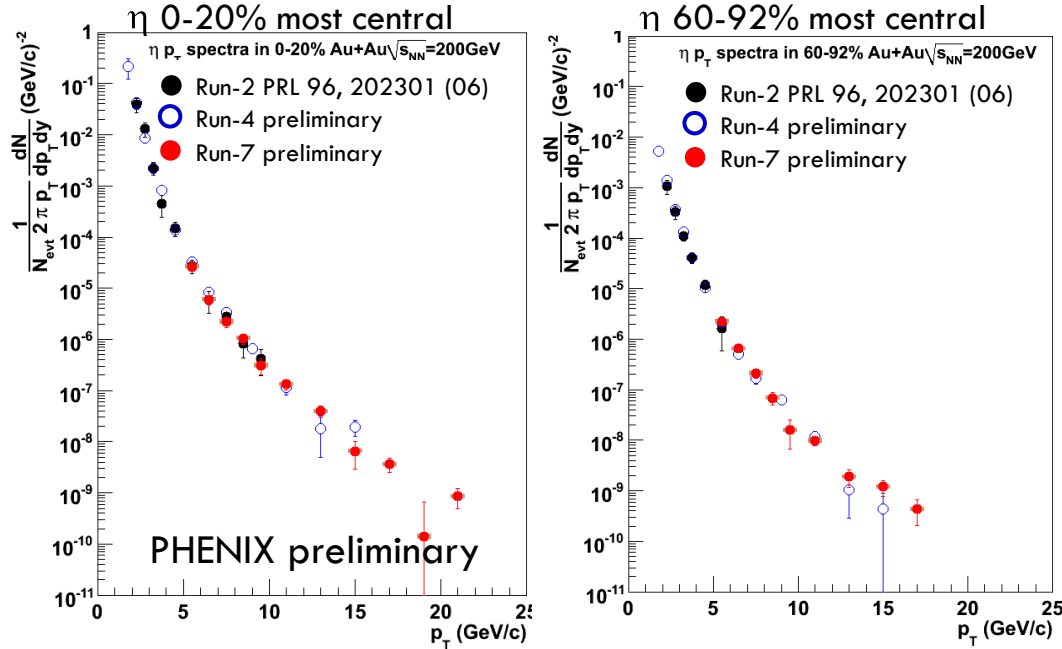
• η yield exceeds π^0 yield
above $p_T \sim 23 \text{ GeV}/c$.

• Systematic error on η
yield should be much
smaller for $p_T > 12 \text{ GeV}/c$
• Because we don't
need to take care of
merging effect

RBRC Review 2009

η invariant yield

10



□ Problem:

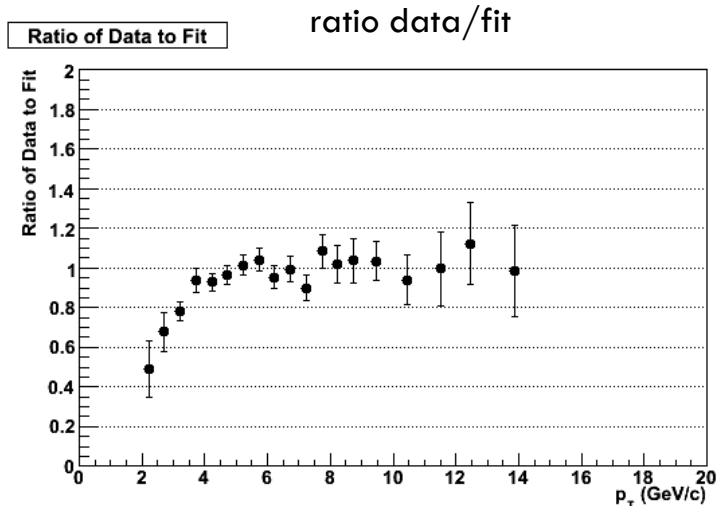
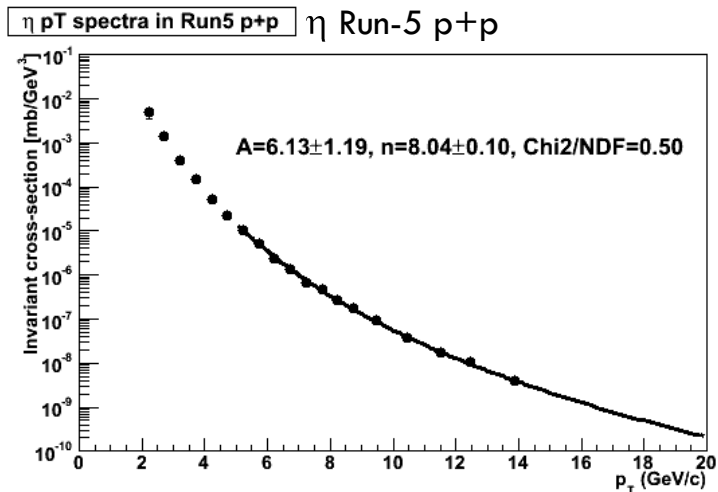
- While η wins over π^0 (in terms of statistics) at 23 GeV, statistics runs out earlier

□ However

- η still provides cross check of π^0 with independent systematics for $13 \text{ GeV} < p_T < 23 \text{ GeV}$, where merging effect is significant

p+p Reference

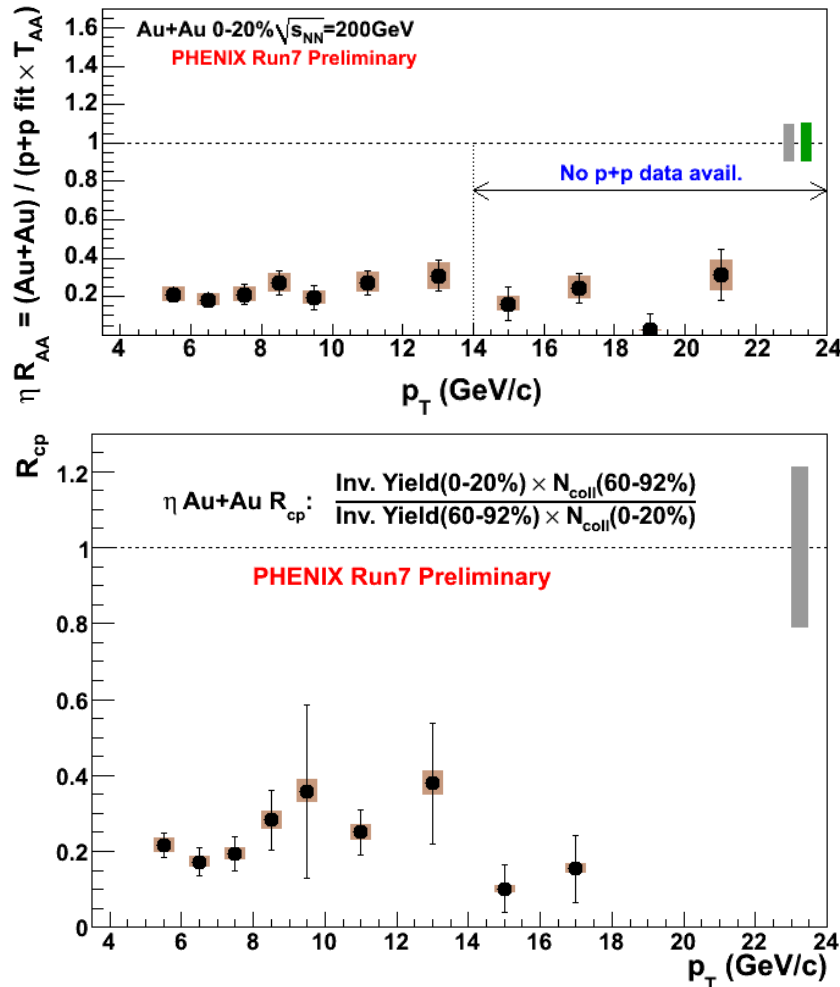
11



- Current p+p data (Run-5) run out at 14 GeV
- Relying on fit to extrapolate to higher p_T
- Alternative
 - ▣ Use π^0 as reference (correcting for η/π^0 ratio)
 - ▣ Problem: π^0 suffers from merging → introduces systematic uncertainty
- Also:
 - ▣ have $\sim 7\times$ p+p statistics in can from Runs 6,9

η R_{AA} , R_{cp}

12

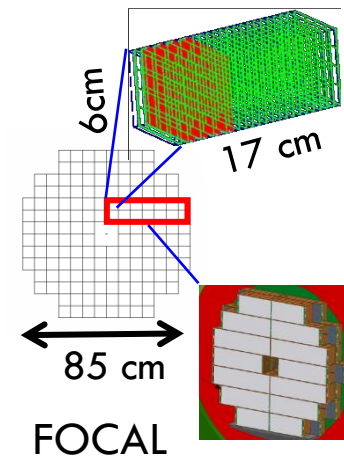


- Independently confirms π^0 R_{AA}
- Like π^0 :
 - Use π^0 as reference (correcting for η/π^0 ratio)
 - consistent with constant p_T dependence
 - But rise with p_T cannot be excluded

The Future

13

- Joining faculty of Baruch College, CUNY, as tenure track professor in February 2010
 - ▣ Joint with RBRC fellowship for first 5 years
- Starting experimental nuclear physics group
 - ▣ Two nuclear theorists already there: Adrian Dumitru (RBRC fellow) and Jamal Jalilian-Marian
- Applying for research grant
- Looking for:
 - ▣ new hardware project in PHENIX
 - Possibly FOCAL
 - ▣ students and postdocs to work with



Baruch College,
Manhattan