Measurements of the space-time extent of the emission source in d+Au and Au+Au collisions through charged pion interferometry at √sNN = 200 GeV

arXiv:1404.4946

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XXIV QUARK MATTER DARMSTADT 2014

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•1. Motivation

Long range azimuthal correlations in central p+A collision show characteristic patterns similar to those in A+A collisions.

They can be reproduced by CGC model as well as viscous hydro model.

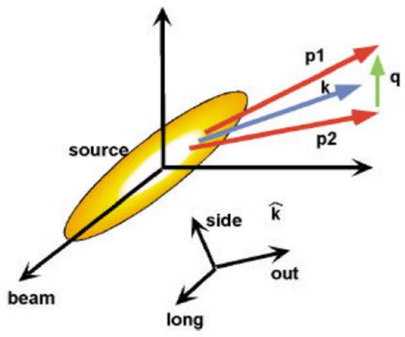
d+Au HBT measurements provide new testing grounds for these models.

•2. HBT Analysis

Two-particle Space-Time Correlation Function

$$C(q) \approx \int dr|\phi(r,q)|^2 S(r,q)$$

r = pair separation q = relative momentum
S= source function $\boldsymbol{\phi}$ = final state interactions



q_{side} - is perpendicular to the beam direction
q_{out} - is parallel to the average transverse momentum of the pair
q_{long} - is along the beam direction

$$C(q_{side}, q_{out}, q_{long}) = (1-\lambda) + \lambda(1+G)Fc\ ,$$

Fc=Coulomb Correction

$$G=\exp(-R_{side}^2 q_{side}^2 - R_{out}^2 q_{out}^2 - R_{long}^2 q_{long}^2)$$

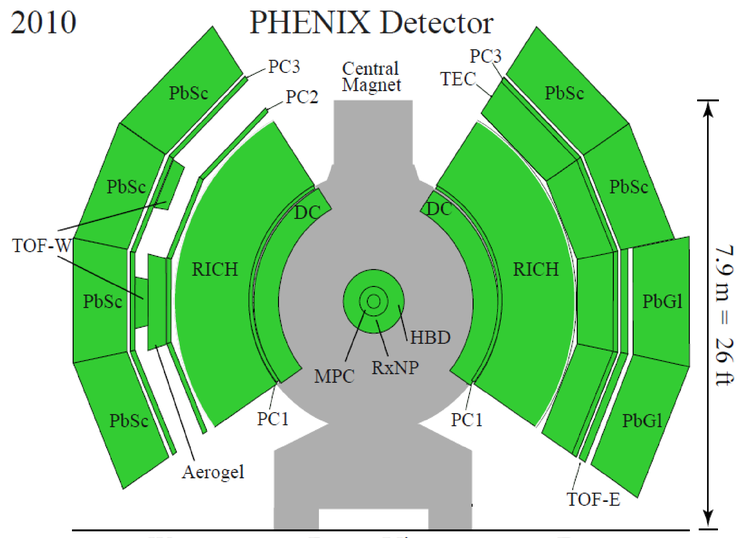
(Pratt)

HBT radii obtained by doing a fit of C to

C_{expt} (q)=A(q)/B(q)

A(q) = q dist. for same event pion pairs
B(q) = q dist. for different event pion pairs
(Sinyukov)

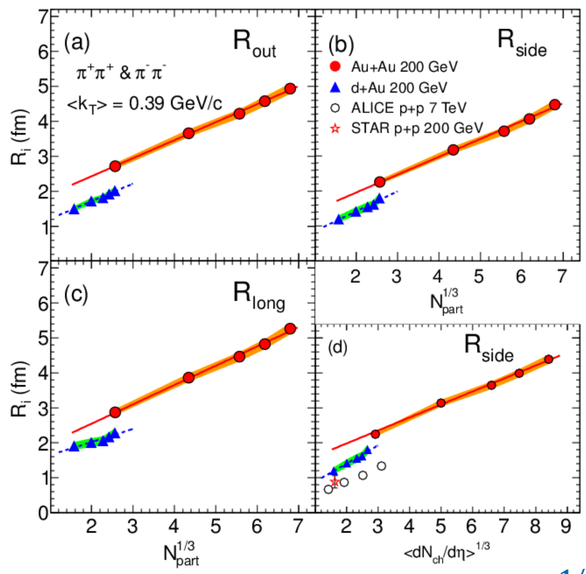
•3. Detector and Data collection



Run 7	200 GeV/c	Au+Au	3.6B evnts
Run 8	200 GeV/c	d+Au	1.0B evnts

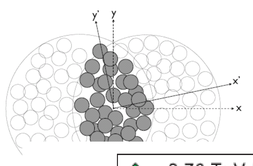
Pion Identification was done in TOF-E and PbSc

•4 $N_{part}^{1/3}$ dependence and $\bar{R}$ scaling



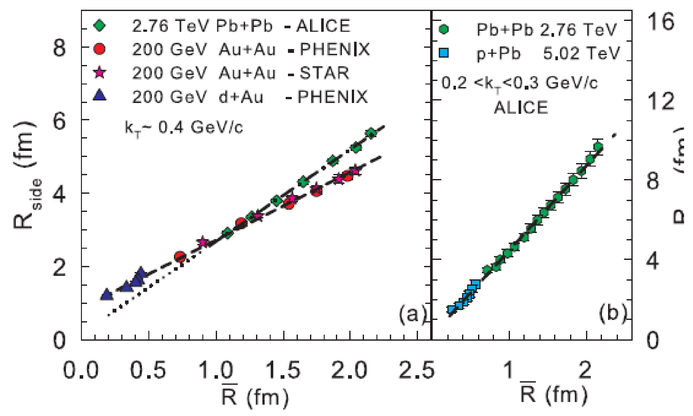
HBT radii (R_{side}, R_{out}, R_{long}) vs $N_{part}^{1/3}$ shows mismatched behavior

Npart ⟹ Initial system size $\bar{R}$ from Glauber Model



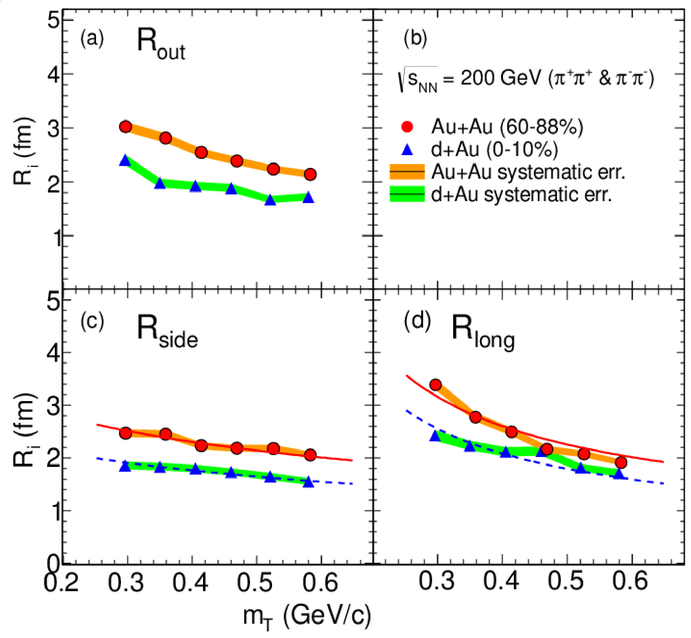
$$\frac{1}{\bar{R}^2} = \sqrt{\left(\frac{1}{\sigma_x^2} + \frac{1}{\sigma_y^2}\right)}$$

σ_x & σ_y → RMS widths of density distribution



R_{side}, R_{inv} vs $\bar{R}$ shows proper scaling behavior

•5 m_T dependence



R_{side}, R_{out}, R_{long} vs m_T for central d+Au and peripheral Au+Au show similar dependence consistent with an expansion scenario

Blast Wave fits shown for R_{side}, R_{long}

•6 Discussion and conclusion

Linear trend for the HBT radii vs $N_{part}^{1/3}$ but d+Au points not in line with Au+Au points.

d+Au points line up with Au+Au data and p+Pb points line up with Pb+Pb when $\bar{R}$ scaling used

HBT radii of (p,d) +A and A+A scale with $\bar{R}$

d+Au m_T dependence similar to that for Au+Au i.e. evidence of expansion seen in Au+Au is also seen in d+Au

Conclusion : Final state scattering effects play an important role in the dynamics of the d+Au system

•References

•Scott Pratt. Coherence and coulomb effects on pion interferometry. *Physical Review D*, 33(1), January 1986.

•Yu.M. Sinyukov et al. Coulomb corrections for interferometry analysis of expanding hadron systems. *Physics Letters B*, 432:248–257, 1998.

•Acknowledgments

•Nuclear Chemistry Group, Stony Brook University
•PHENIX collaboration