BNL/PHENIX Group

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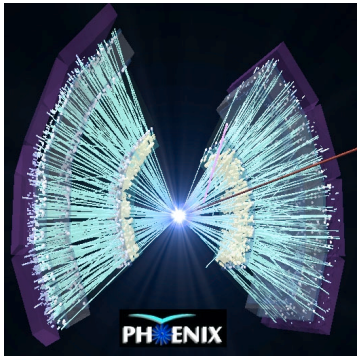
Brookhaven National Laboratory
Upton, NY 11973 USA



RHIC Science & Technology Review
July 7, 2005

Manpower
&
Current Support

Scientific Manpower from FWP=18/2.25

2.2 PHENIX Scientific Personnel: S. Belikov (50%); H. Buesching, Post-doc (50%); G. David (75%); A. Franz (25%); J. Haggerty (25%); B.Johnson (25%); E. Kistenev (50%); A. Milov, Post-doc-Goldhaber (50%); S. Mioduszewski (75%); J. Mitchell (75%); D.Morrison (50%); E. O'Brien (25%); C. Pinkenburg (25%); M. Purschke (25%); T. Sakaguchi (0%); M. Tannenbaum (75%); S. White (25%); C. Woody (50%); post-doc replacement (0%). Note that due to flat-flat funding in FY 2002, FY 2003, FY2004 (and projected for FY 2005) we could not replace J. Velkovska who left for a Faculty Position in 2003. M. Harvey left group for Faculty Position, Sept. 2004, replaced by A. Milov (Goldhaber Fellow, starting May 1, 2005). T. Sakaguchi is new hire for position vacated by H. Ohnishi in 2002. S. Sato left group for position at JAERE, Feb. 2004, position is open.

FTE Res 8.8	Res 8.4	Res 8.25	Res 7.25	
Ops 9.1	Ops 9.3	Ops 9.10	Ops 9.75	

Year	FY2002	FY2003	FY2004	FY2005
Labor	1750	1701	1845	1730
MST	374	361	320	420
Total K$	2124	2062	2165	2150

PHENIX 2005 Organization---*BNL Group Members in Red Italics*

Executive Council

Y. Akiba	RIKEN
V. Cianciolo	ORNL
A. Deshpande	SUNYSB
A. Drees	SUNYSB
A. Frawley	FSU
M. Gonin	E Polytech.
V. Greene	Vanderbilt
M. Grosse-Perdekamp	UIUC
D. Morrison	*BNL*
E. O'Brien	*BNL*
N. Saito	Kyoto
R. Seto	UCR
W. Zajc*	Columbia
*B. Johnson**	*BNL*

Former EC Members

M.Tannenbaum	*BNL*
S. White	*BNL*

Detector Council

Y. Akiba	RIKEN
C.Y. Chi	Columbia
O. Drapier	E Polytech.
A. Drees *	SUNYSB
A. Frawley	FSU
A. Franz	*BNL*
V. Greene	Vanderbilt
H. Hamagaki	CNS-Tokyo
J. Haggerty	*BNL*
J. Lajoie	ISU
D. Lynch	*BNL*
C. Maguire	Vanderbilt
Y. Miake	Tsukuba
D. Morrison	*BNL*
J. Nagle	U. Col.
*E. O'Brien *	*BNL*
V. Pantuev	SUNYSB
M. Purschke	*BNL*
K. Read	U. Tenn
T. Sugitate	Hiroshima
H. Van Hecke	LANL
S. White	*BNL*
D. Winter	Columbia

Physics Working Group Conveners

K. Barish	UCR
M. Brooks	LANL
H. Buesching	*BNL*
T. Chujo	Vanderbilt
A. Deshpande	SUNYSB
S. Esumi	Tsukuba
A. Frawley	FSU
J. Jia	Columbia
J. Lajoie	ISU
S. Milov	*BNL*
K. Reygers	Munster
R. Soltz	LLNL
W. Xie	RBRC

Former PhysicsWorking Group Conveners

G. David	*BNL*
A. Franz	*BNL*
S. Mioduszewski	*BNL*
J. Mitchell	*BNL*
D. Morrison	*BNL*
M.Tannenbaum	*BNL*
J. Velkovska	*BNL*
S. White	*BNL*

*= Chair

*=sec'y

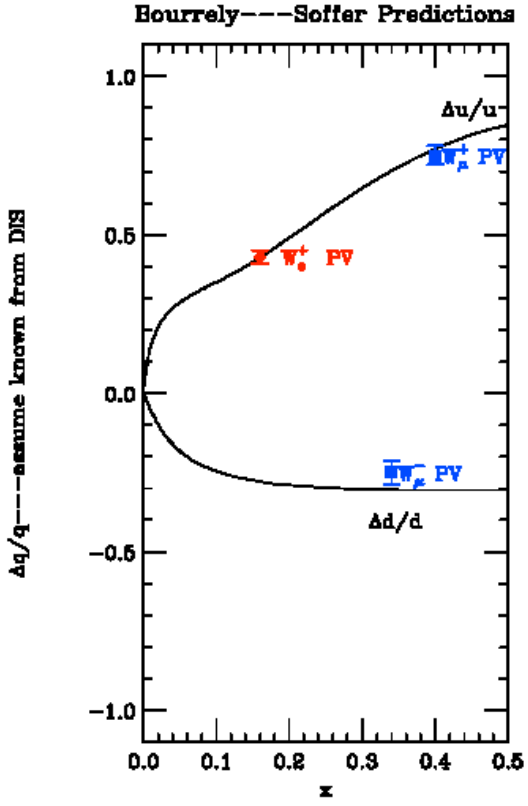
BNL/PHENIX Group: Science & Priorities

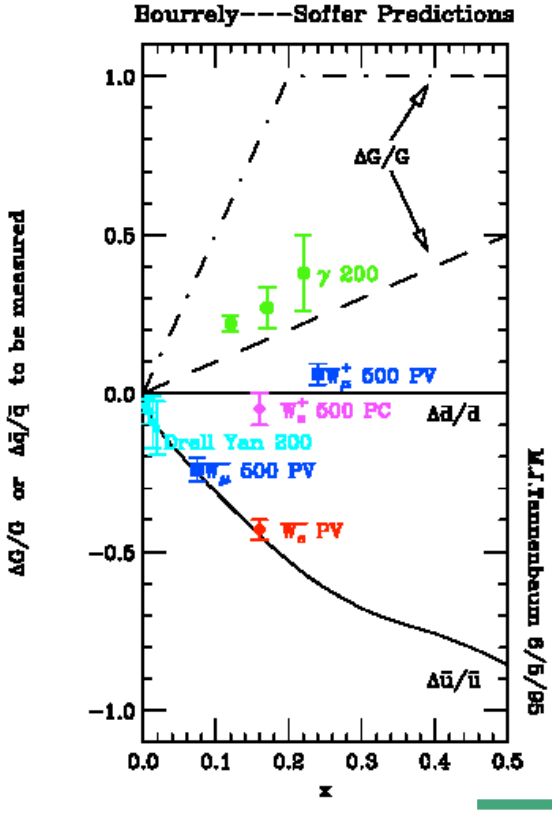
BNL/PHENIX Group---Science

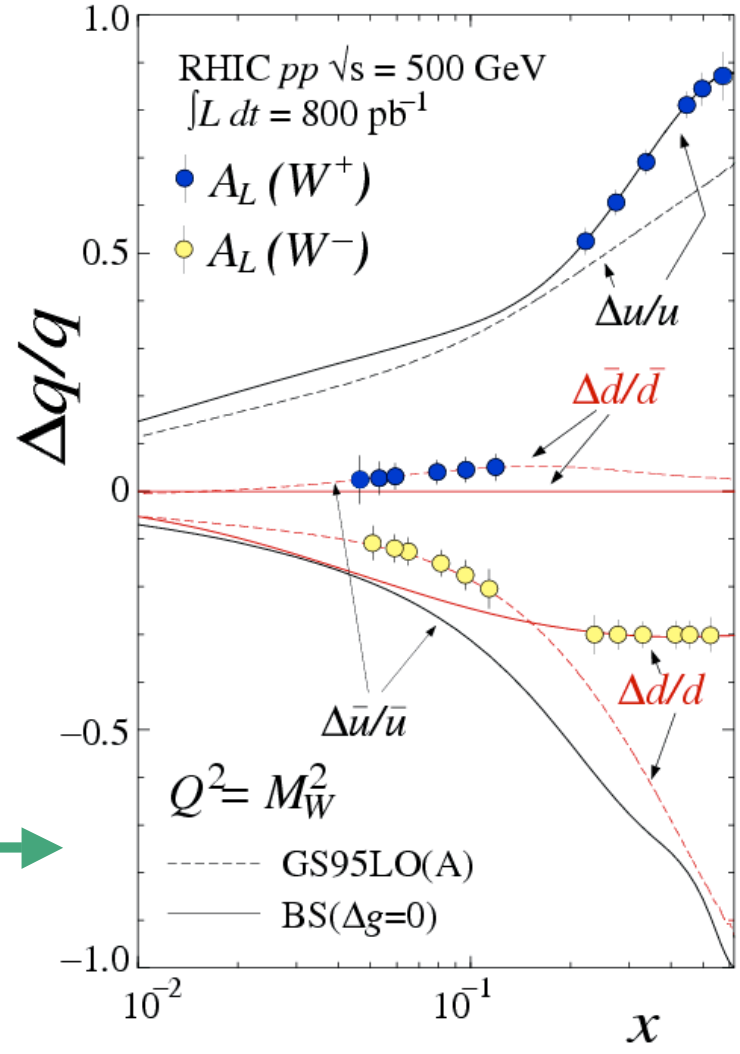
- Designed detector to detect the QGP according to 1980's view
  - thermal photons and leptons, J/Psi at mid-rapidity (rare events)
  - plus wanted all possible signatures to switch on/off together
- Originated RHIC Spin Program
  - Gluon (spin) structure function by direct γ $10 < p_T < 25$ GeV/c
  - Flavor identified structure functions by Parity Violating $W^{\pm} \rightarrow l^{\pm}$
  - New Physics via Parity Violation in ~100 GeV jets.

- Impact on PHENIX experiment
  - High $p_T \geq 25$ GeV/c π^0 $\gamma \rightarrow$EMCal$\rightarrow$Segmentation$\rightarrow$JetQuenching
  - low p_T J/Psi, $e^{\pm}$ pairs $\rightarrow$ B=0 on axis, extremely low X_0 in aperture, EMCal-RICH electron trigger $\rightarrow$ HBD
  - Charm via single $e^{\pm}$, converter method to separate from photonic
  - W^+ and W^- $\rightarrow$ high res. tracking $e_{id} > 5$ GeV/c $\rightarrow$TRD, Kalman
  - Identified charged hadrons $\rightarrow$ EMCal TOF, Precision TOF $\rightarrow$AERC

RSC: γ $W^{\pm}$

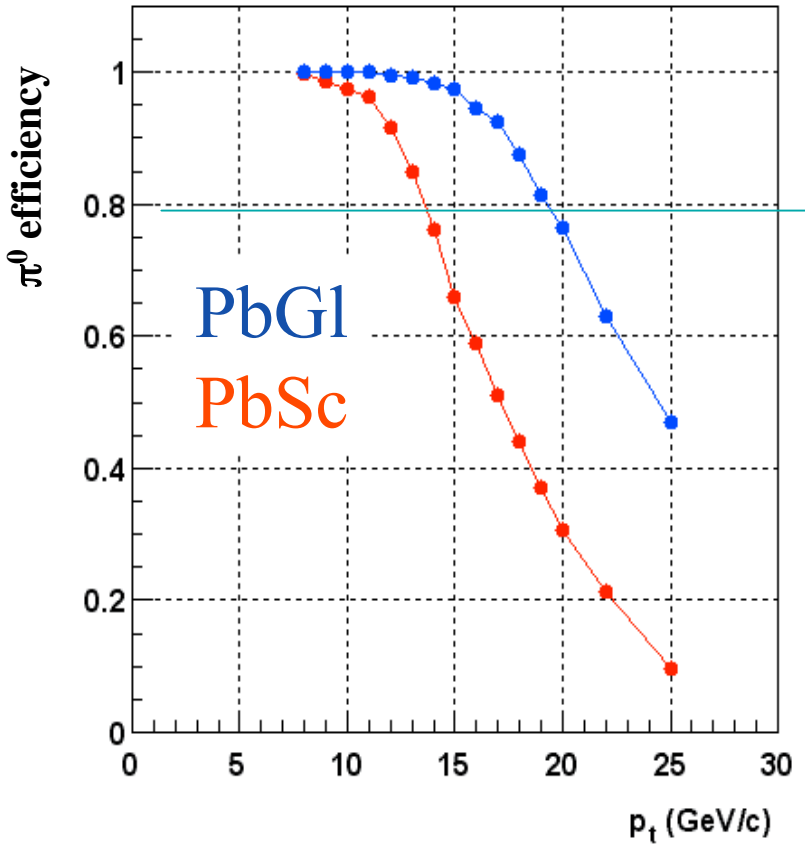


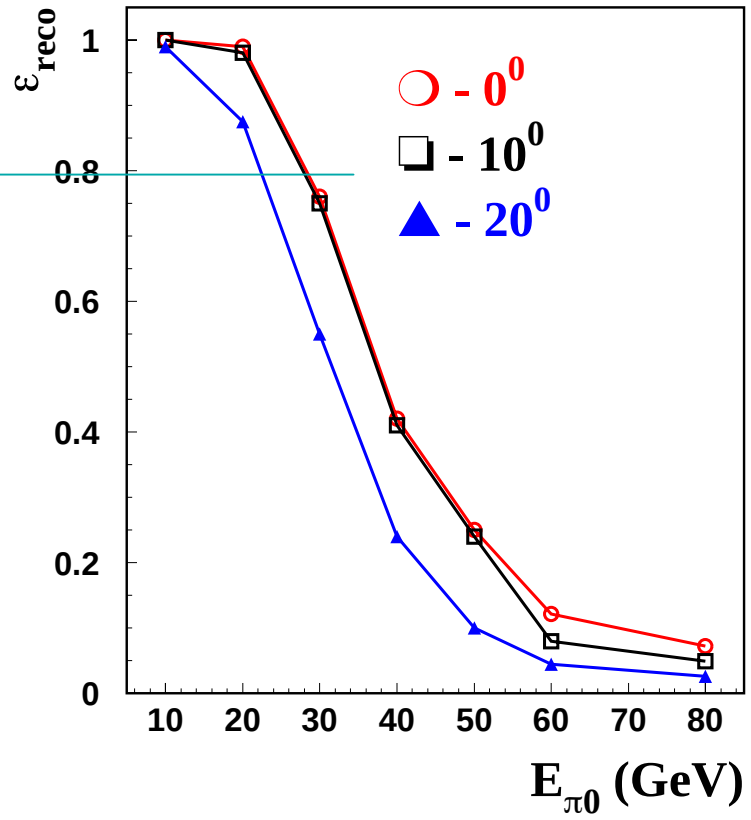




π^0 γ Separation

at QM2005 π^0 in Au+Au for $p_T > 20$ GeV/c





With profile cut

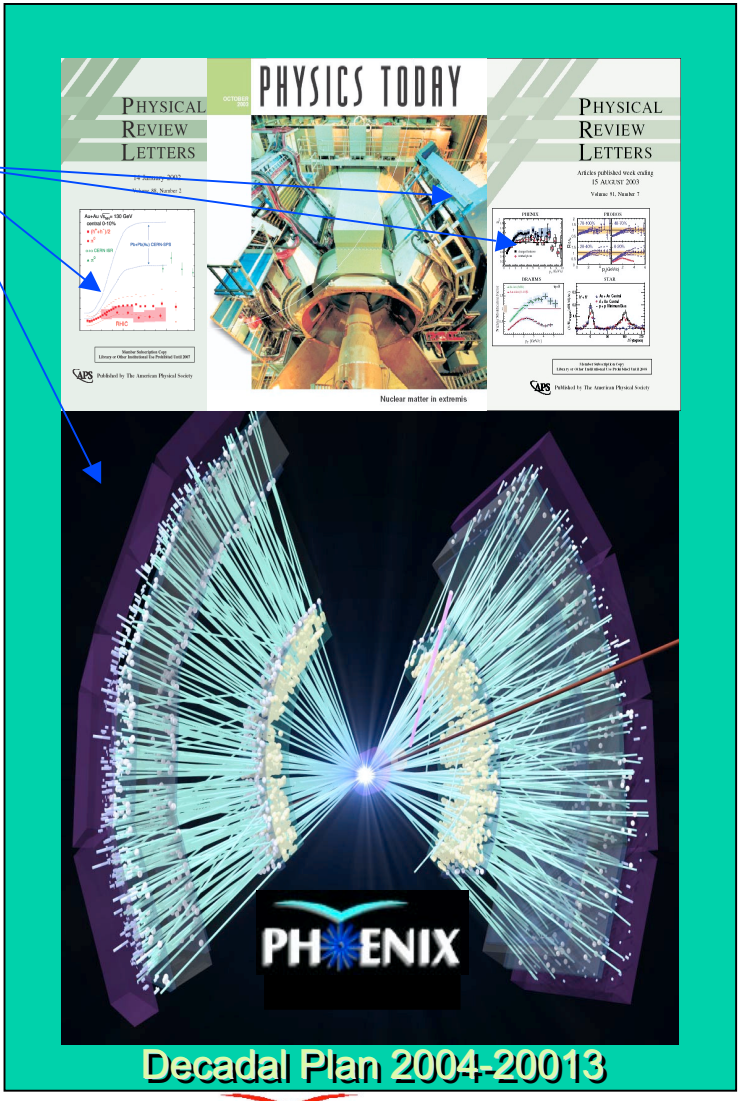
Group members play a leading Role in the PHENIX Experiment

Leading role of BNL/PHENIX group members as shown on the Decadal Plan

Research activities in which the group plays a leading role follow from the detector and technical activities

and vice-versa:

- High p_T π^0 and identified hadrons
- direct photons
- charm and J/Psi
- event-by-event averages
- Global event characterization
- Jet properties via 2-particle correlations

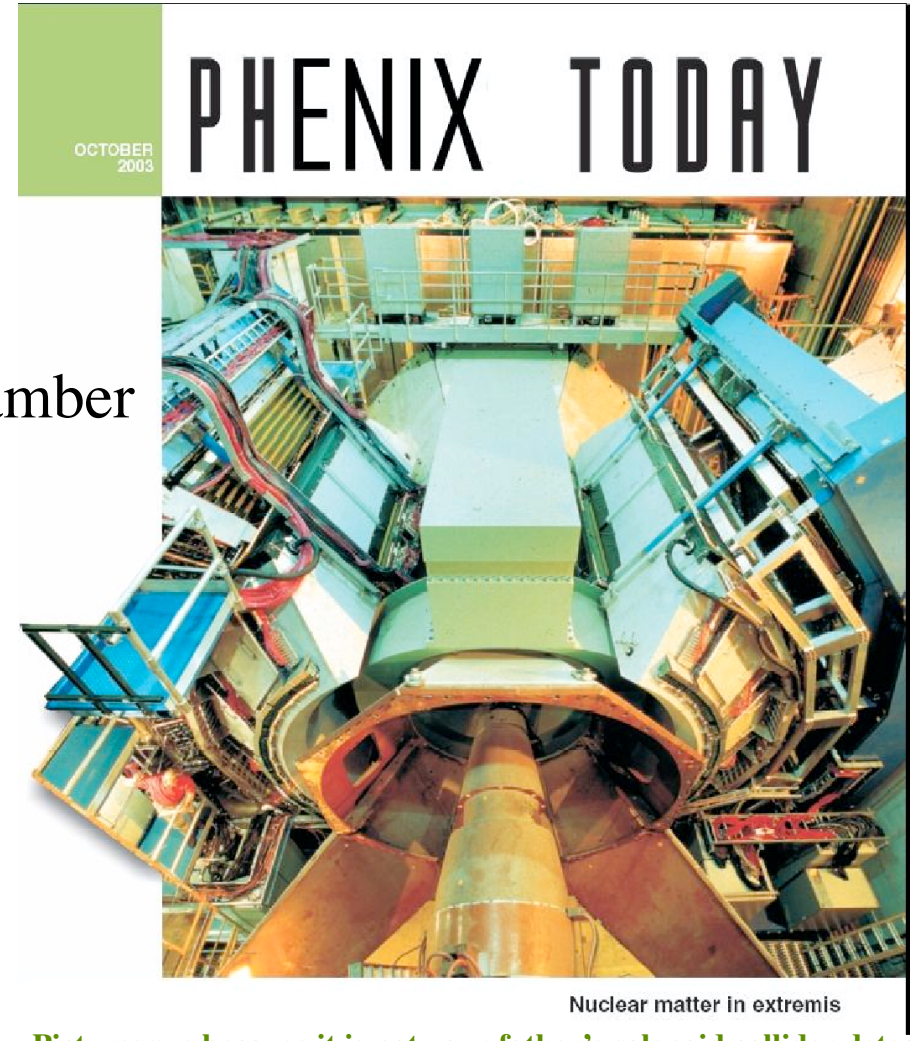


"Mike, is there a `real collider detector' at RHIC?---J. Steinberger "

Subsystems originated, built and operated by BNL/PHENIX group:

- EMCal (PbSc)
- TEC/TRD-Time Expansion Chamber
- ZDC/SMD-Zero Degree Cal.
- ONCS-OnLineControlSystem
- DAQ-Data Acquisition
- Offline Core Software
- Global Tracking
- Magnets

- Pad Chamber



Picturesque because it is not your father's solenoid collider detector

Group Scientific Research Chart

PHENIX

scientist
post-doc
post-doc Japan
[left group] **new hire**

leading
contributing

γ,π,η,γγγ…
H. Buesching
G. David
E. Kistenev
S. Mioduszewski
M. Purschke
T. Sakaguchi
M. Tannenbaum
S. White
C. Woody

PID Hadrons
[T. Chujo]
[M.Harvey]
D. Morrison
[H. Ohnishi]
[S. Sato]
[J. Velkovska]

Event-by-Event
J. Mitchell
M. Tannenbaum

Global
S. Belikov
A. Franz
E. Kistenev
A.Milov
D. Morrison
M. Tannenbaum
S. White

anti-n New Physics
S. Mioduszewski
D. Morrison
C. Pinkenburg

Publications
B. Johnson

Jets via 2-Particle Correlations
M. Tannenbaum

Charm, e, J/Psi
E. Kistenev
A.Milov
E. O'Brien
T. Sakaguchi
M. Tannenbaum

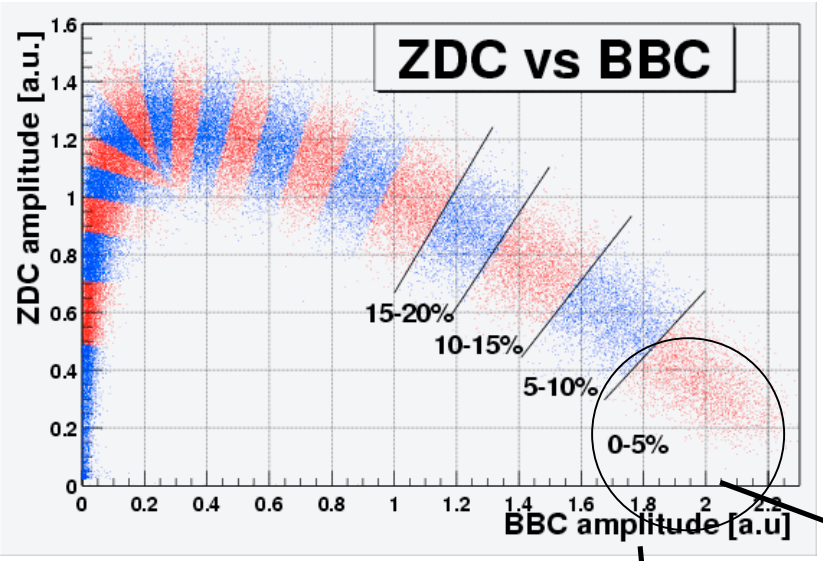
DAQ R&D
S.Belikov
J. Haggerty
C. Pinkenburg
M. Purschke

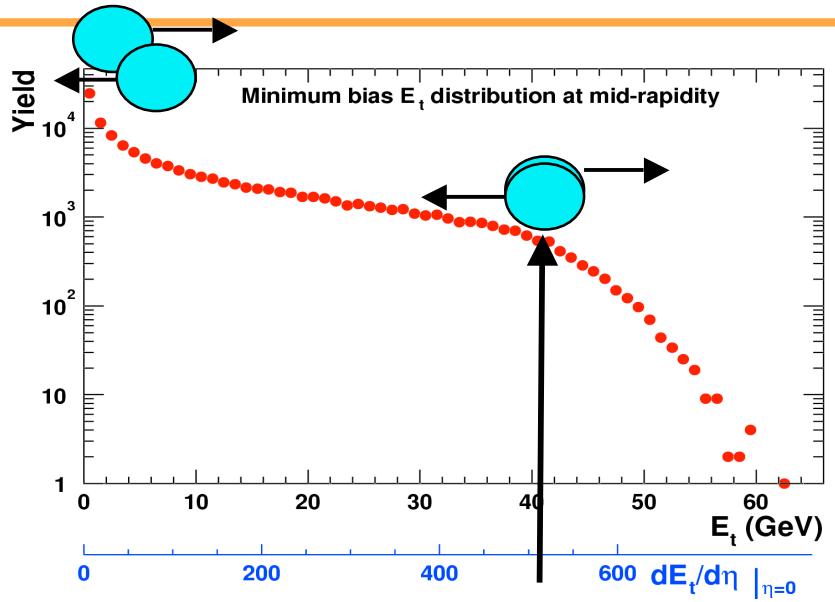
Upgrade R&D
J. Haggerty
E. Kistenev
A. Milov
J. Mitchell
D. Morrison
E. O'Brien
[S. Sato]
C. Woody

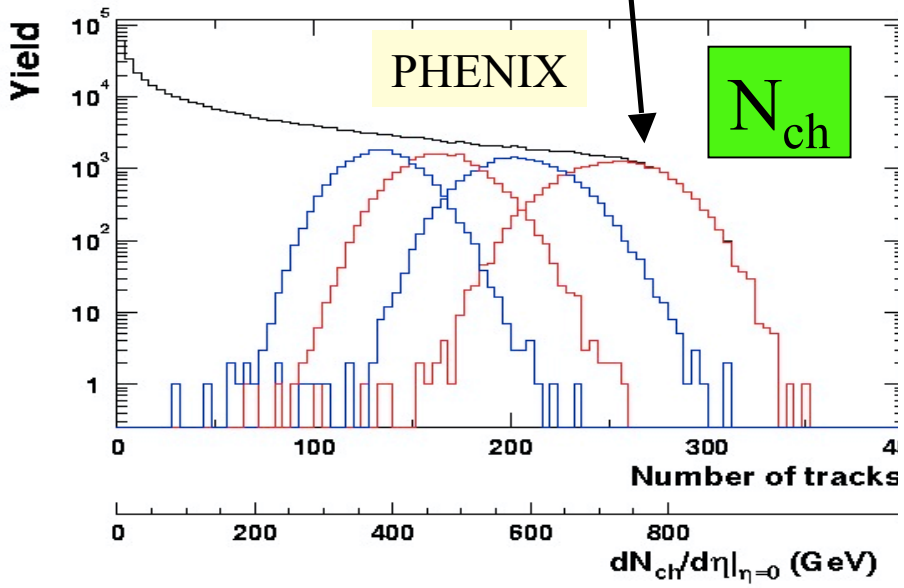
Software R&D
S. Mioduszewski
J. Mitchell
D. Morrison

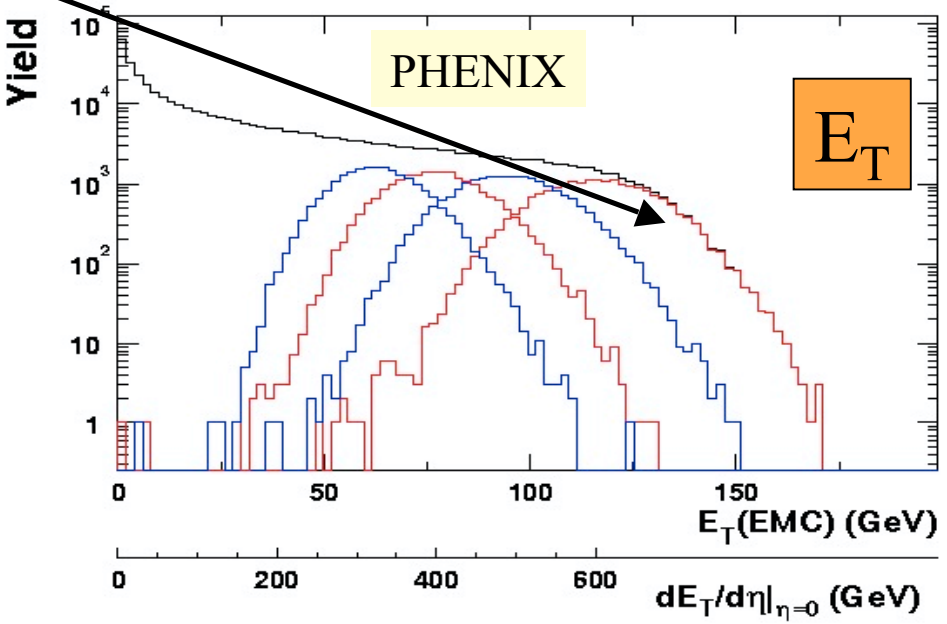
Misc R&D
B. Johnson
C. Woody
S. White

$N_{charged}$, E_T Centrality--Nuclear Geometry EMCal measures ε_{Bj}

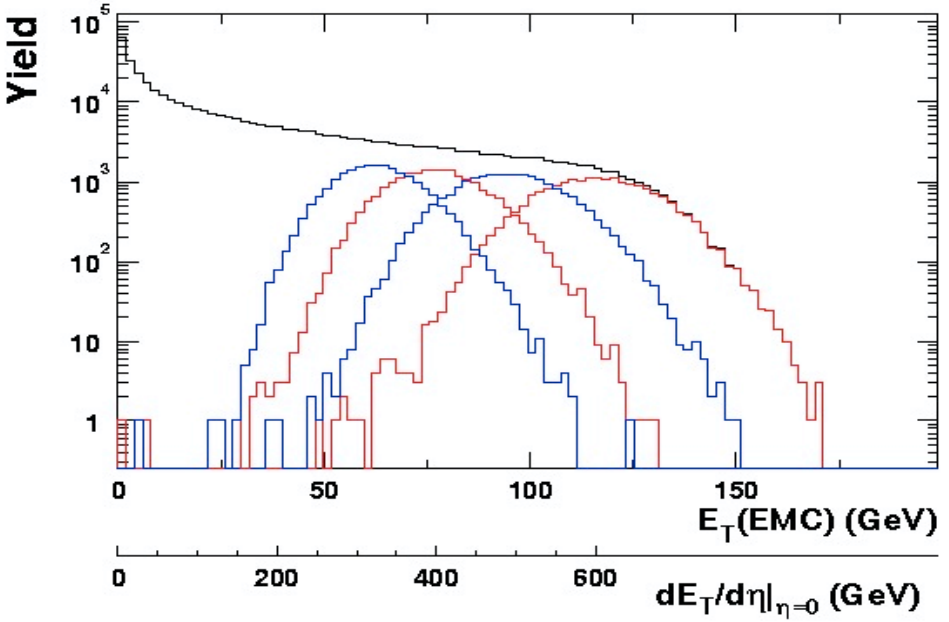


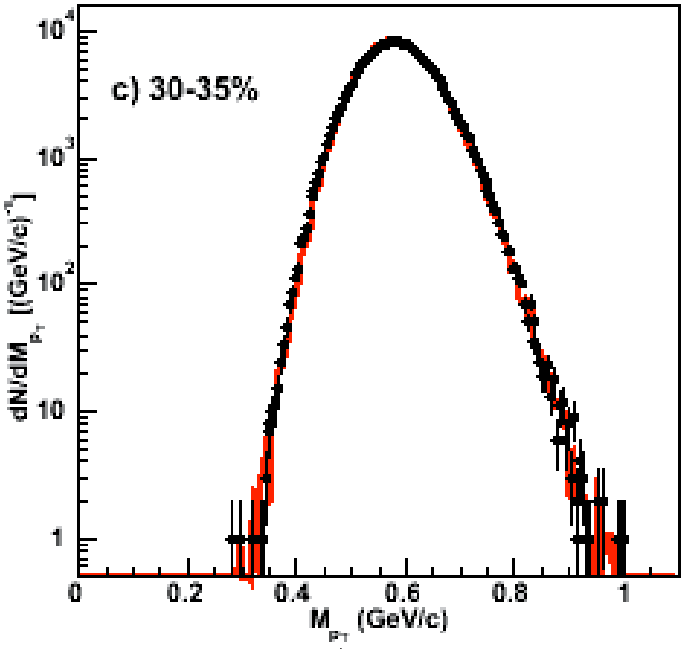






Are there fluctuations beyond random?





- Event-by-event average p_T (M_{pT}) is closely related to E_T

$$M_{p_T} = \overline{p_T}_{(n)} = \frac{1}{n}\sum_{i=1}^{n} p_{T_i} = \frac{1}{n} E_{Tc}$$

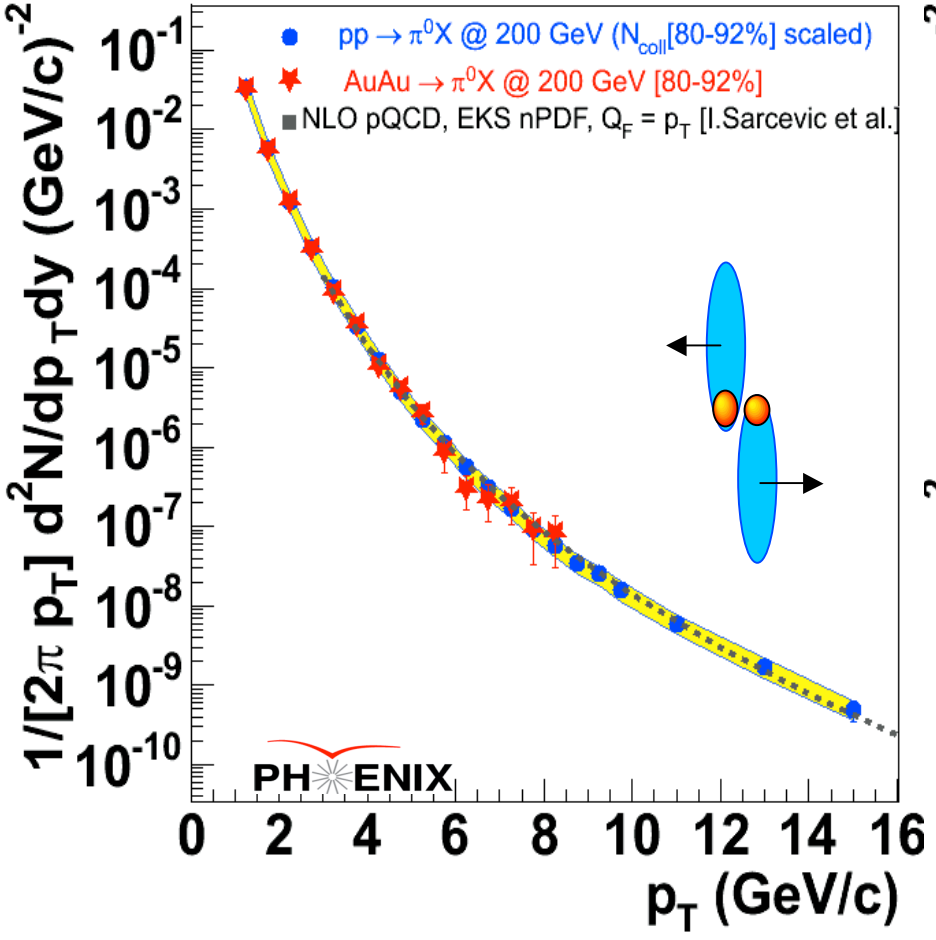
- compare Data to Mixed events for random.
- deviation expressed as:

$Fp_T = \sigma_{MpTdata} / \sigma_{MpTmixed} - 1$ ~ few %

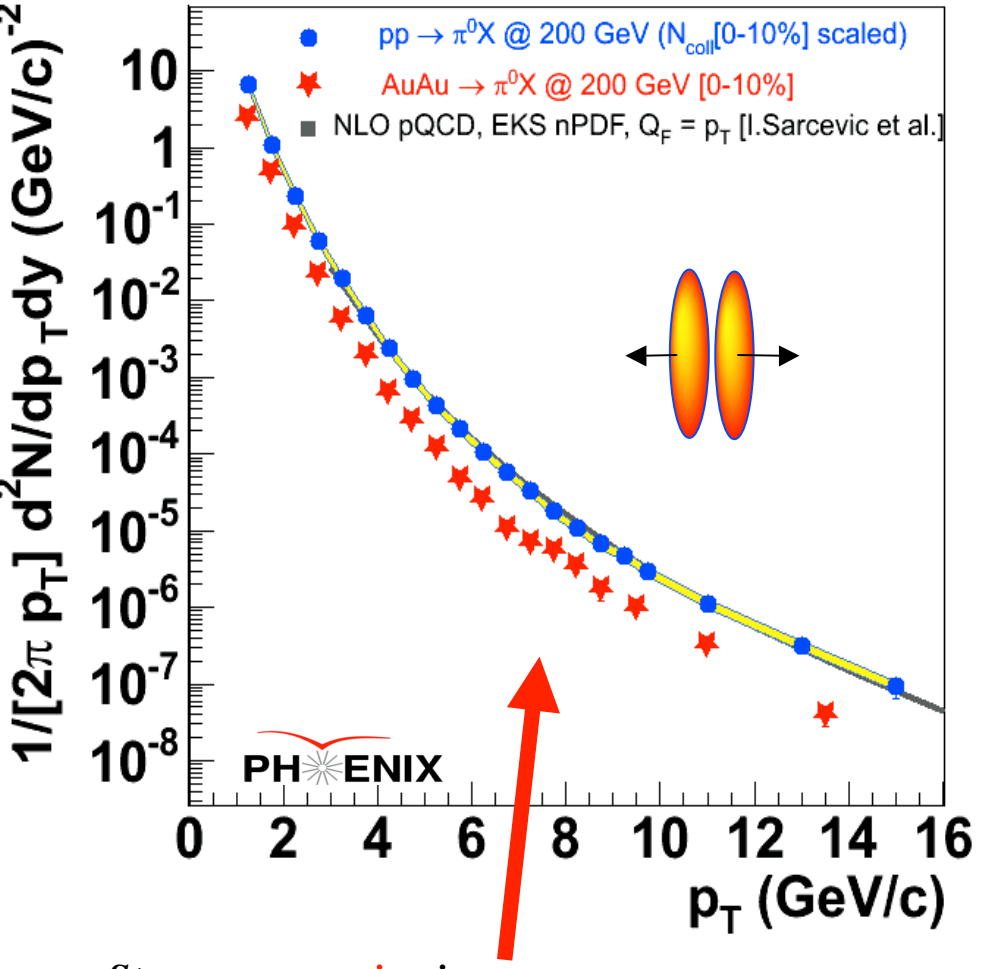
- Non-Random fluctuations small ~few %
- due to jets see PRL **93**, 092301(04)

Au+Au at RHIC--strong suppression of high p_T π^0

Au+Au→ π^0 *X (peripheral)*



Au+Au→ π^0 X (central)



Peripheral data agree well with p+p (data & pQCD) scaled by T_{AB} (N_{coll}-)

Strong suppression in central Au+Au collisions

PRL 91, 072301 (2003)

R_{AA} (π^0) AuAu:pp 200GeV
High p_T Suppression flat from 3 to 10 GeV/c !!

$$R_{AA} = \frac{\text{Yield}_{AuAu}(p_T)}{\langle T_{AB}\rangle_{AuAu} \times \sigma_{pp}(p_T)}$$

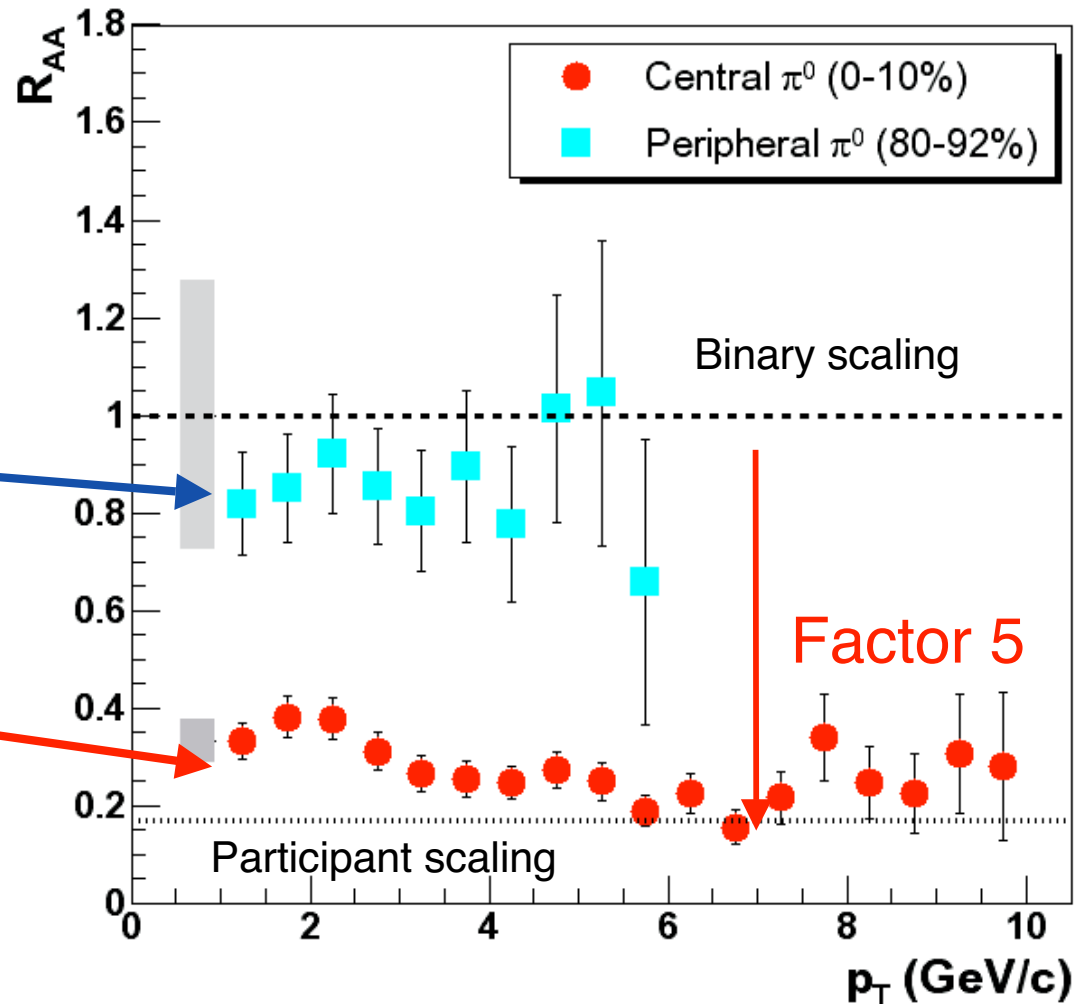
Peripheral AuAu - consistent with N_{coll} scaling (large systematic error)

Large suppression in central AuAu - close to participant scaling at high P_T

Flat $R_{AA} \Rightarrow \Delta E/E$=const

Theory ΔE=Const~ L^2

How high in p_T is$\Delta E/E$=const ?



PRL 91, 072301 (2003)

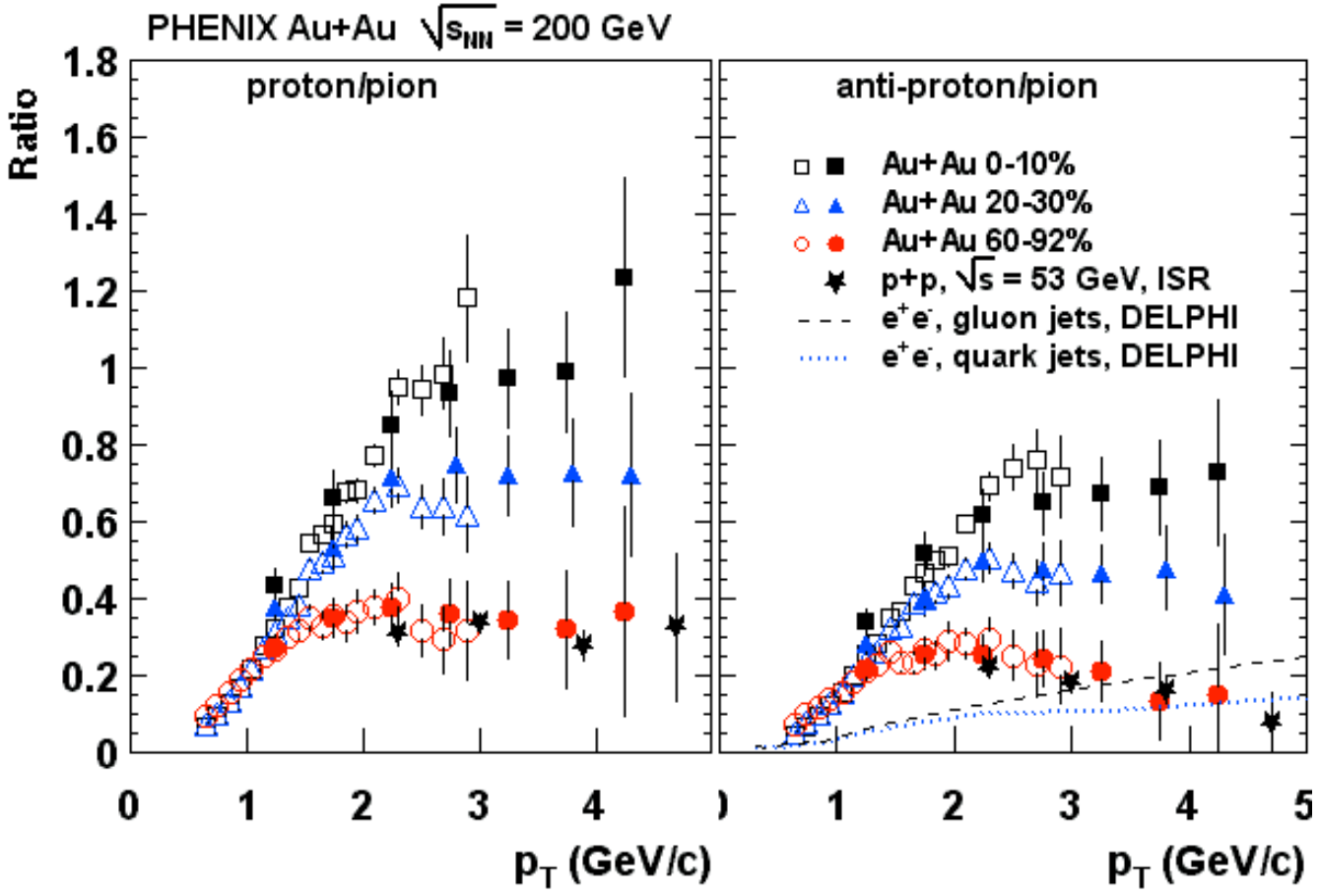
Particle ratios---inclusive and at high p_T

inclusive vs centrality-nothing much

but PRC **69** 034909 (2004) cited 122 times, so far

Au+Au $\sqrt{s_{NN}}$=200 GeV

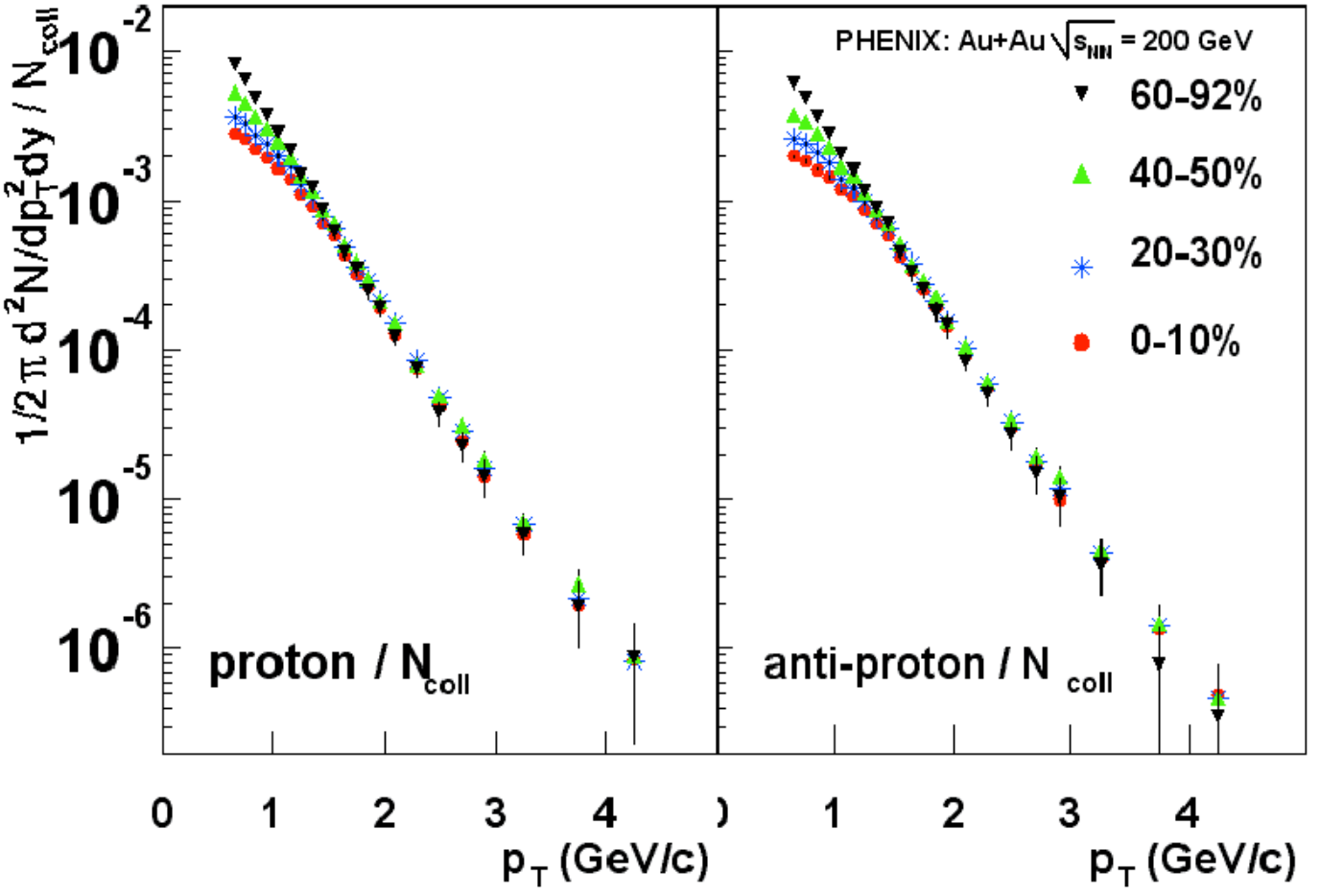
dramatic increase with centrality vs p_T



PRL **88**, 024301 (2002), PRL **91**, 172301 (2003)

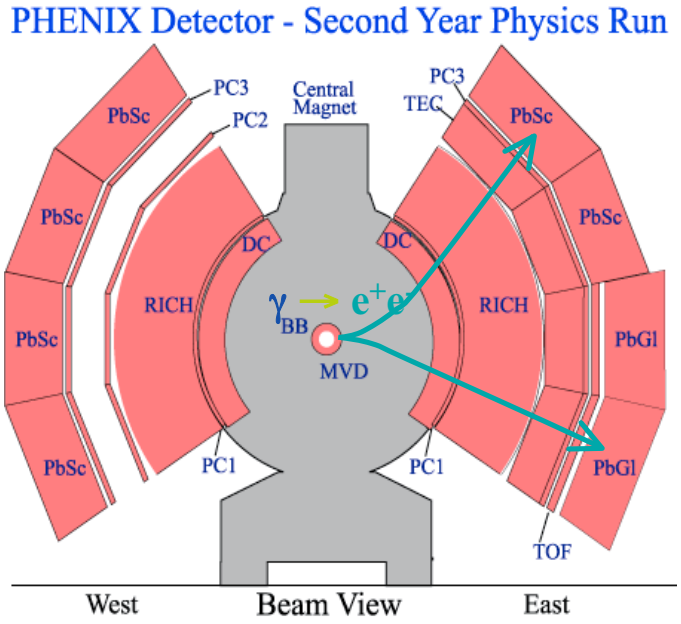
protons: N_{coll} scaling with centrality, radial flow

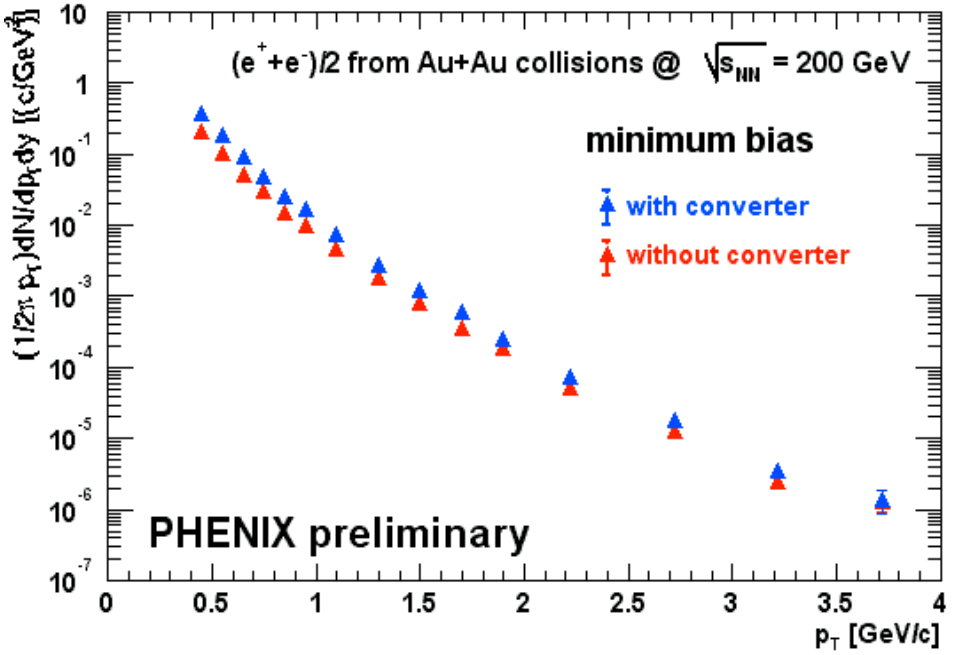
PRL **91**, 172301 (2003)



protons scale with N_{coll}, π suppressed: why do we say p are anomalous ?

QM02→04 AuAu 200 GeV charm via e±





- Some data with 1.7 % X_0 converter added
- converter only affects photonic component

- converter effect is much greater at low p_T, indicating
  - ⇒ relatively much larger photonic component at low p_T
  - ⇒ relatively smaller phtonic (i.e. larger non-photonic) component at higher pT (i.e. charm)

Reduced systematic erros.

BNL/PHENIX Group---PRIORITIES

- Run and improve the detector, daq, etc. Take more and better data.
- Publish all papers from Runs 2, 3, 4.
- Determine whether medium at RHIC is `classical' QGP, or what else?
  - thermal photons and leptons, J/Psi at mid-rapidity (rare events)
  - Upsilon and Drell-Yan---Detector can do it, just need luminosity.
  - Specific heat, thermal properties, fluctuations
- Follow up on our discoveries to learn the properties of the actual medium (fluid?) and to study energy loss phenomenon in detail.
  - ΔE ~const, then why is R_{AA} flat vs p_T?; is $\Delta E \sim \rho L^2$?$\Rightarrow$ Understand energy loss as a function of p_T, particle type, quark flavor, mass, time (distance) in medium $\Rightarrow$ studies vs centrality, angle to reaction plane, c.m. energy for identified particles and particle correlations hard and soft. Source of p/π anomaly? How about U+U collisions?
  - Flow: do particles or quarks flow, charm flow, J/Psi flow, mach flow? Is charm suppressed in AuAu?
  - New phenomena in A+A, Pentaquark, Parity Violation?

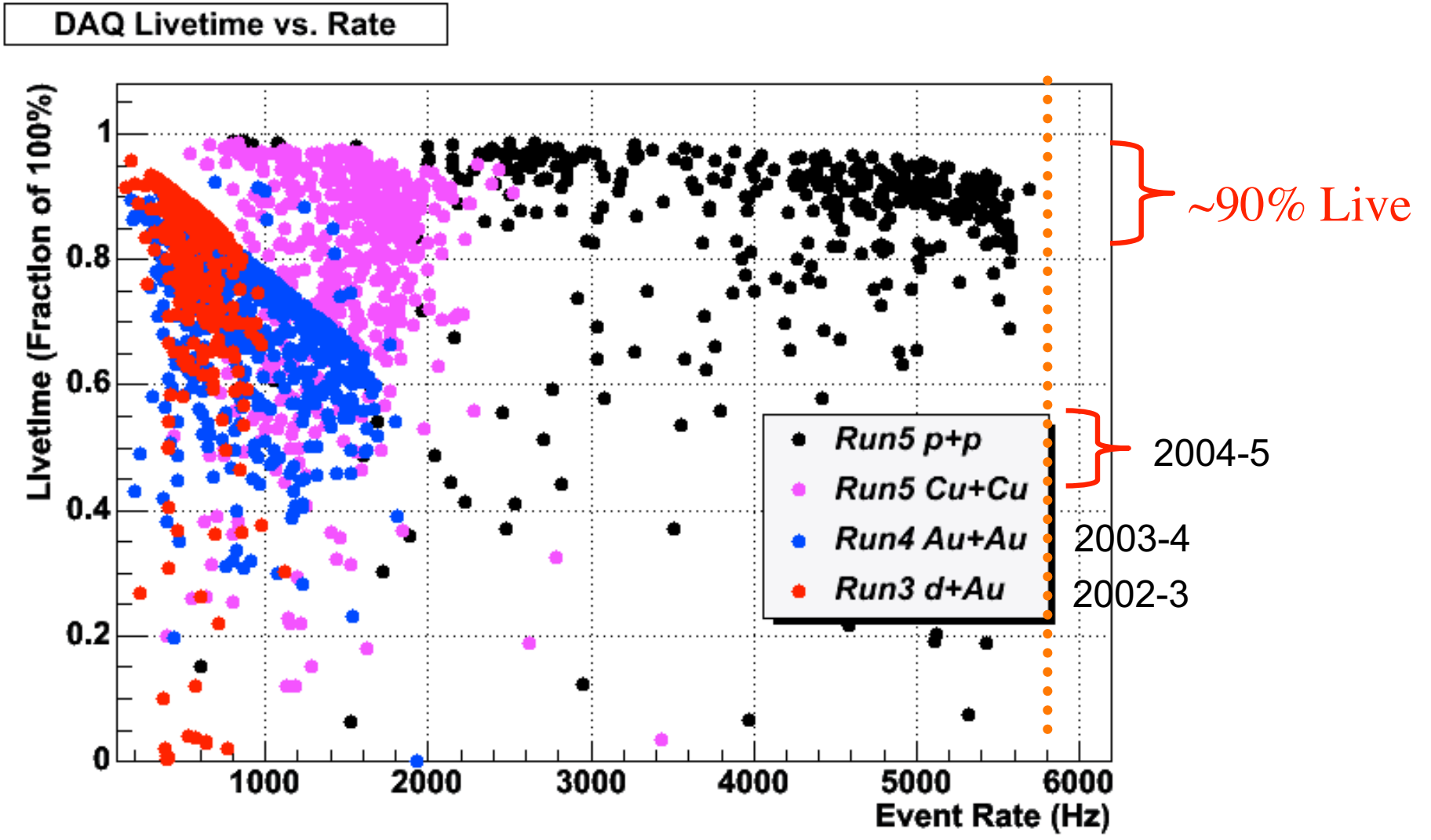
BNL/PHENIX Group---PRIORITIES-II

- RHIC Spin Program
  - Gluon (spin) structure function by direct γ $10 < p_T < 25$ GeV/c
  - Flavor identified structure functions by Parity Violating $W^{\pm} \rightarrow l^{\pm}$
  - New Physics via Parity Violation in ~100 GeV jets.
- RHIC Upgrades---PHENIX could operate as is
  - Higher Luminosity, Heavier Beams U+U, smaller diamond
- Detector Upgrades---New Physics
  - HBD: allows low mass e^+ e^-: ρ, ω, φ, continuum
  - SVX: Charm flow, suppression, AERC Pid to 20 GeV/c D->Kπ, B meson? Conflict with J/Psi, single e, e^+e^- program which needs lots more int luminosity (Run 8 AuAu + probably more). Priority depends on how much more J/Psi low p_T data is needed
  - Nose Cone Calorimeter: gluon structure function vs A at low x high p_T via γ+Jet: has never been measured, vital input for RHIC AA, vital for Color Glass Condensate physics

BNL/PHENIX Group Accomplishments & Plans

See slides 50-54 (extra) for group contributions to individual pubs.

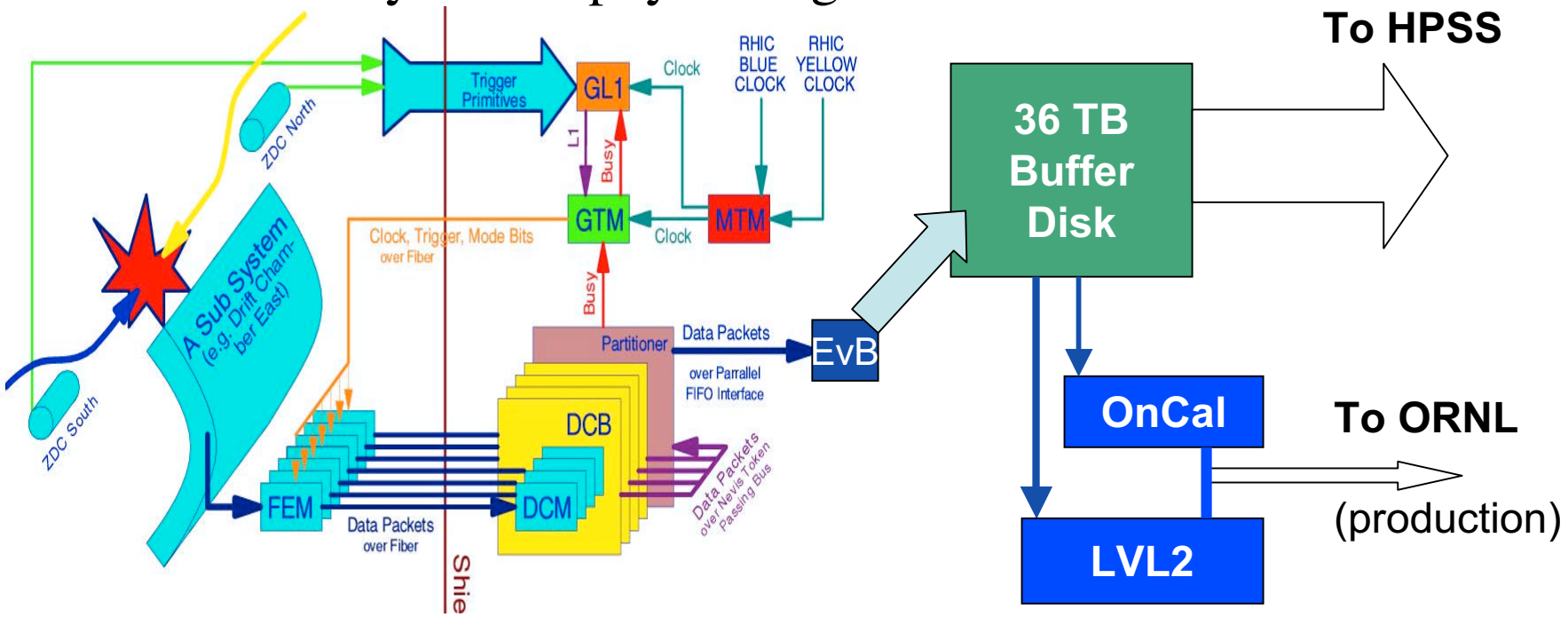
PHENIX DAQ Performance-High Efficiency



Improvements made by BNL/PHENIX group

- Improved DAQ efficiency---faster initialization, etc
- Improved DAQ rate (>5kHz)
- Multi-Event Buffering (95% live)
- Higher Speed Event Builder Interface (JSEB)
- OnCal calibrations
- LVL2 Filtering rare events
- Additional Buffering in the Counting House
- Improved LV and HV control, Improved data base, Wiki
- Safety Enhancements

- PHENIX placed a strong emphasis in Run-5 on the semi-real time production of rare event data.
  - ✓Online Calibrations (OnCal) performed for every run
  - ✓Level-2 (LVL2) filtering run on Level-1 triggered events
    - Output a few % of total data
    - Very rich in physics signals!



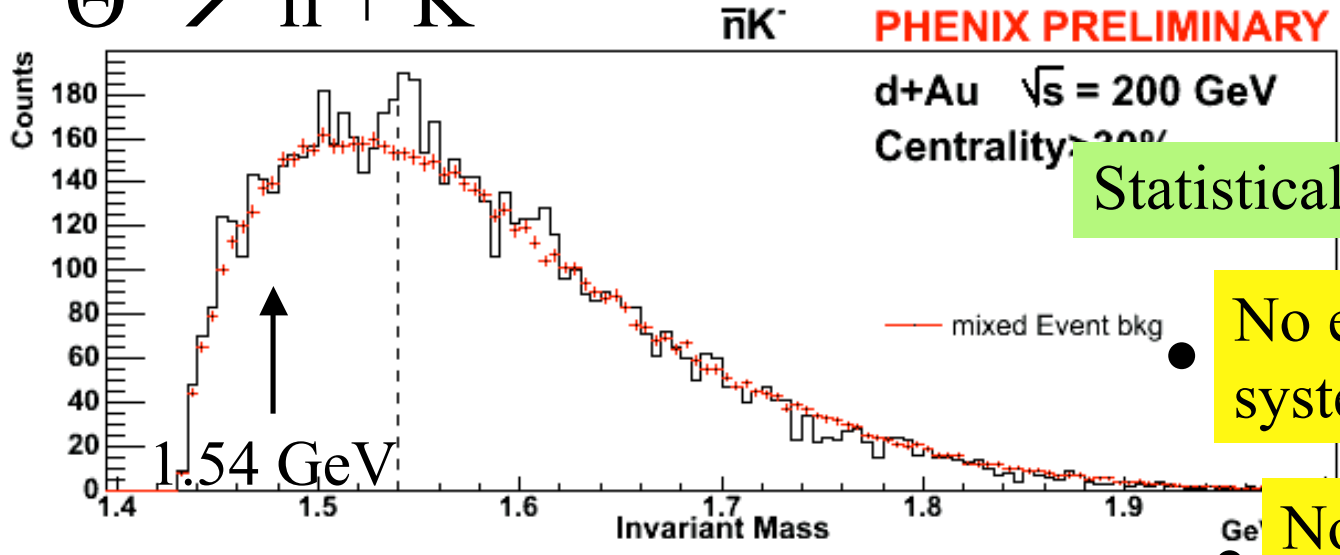
Actually, We are the Champions

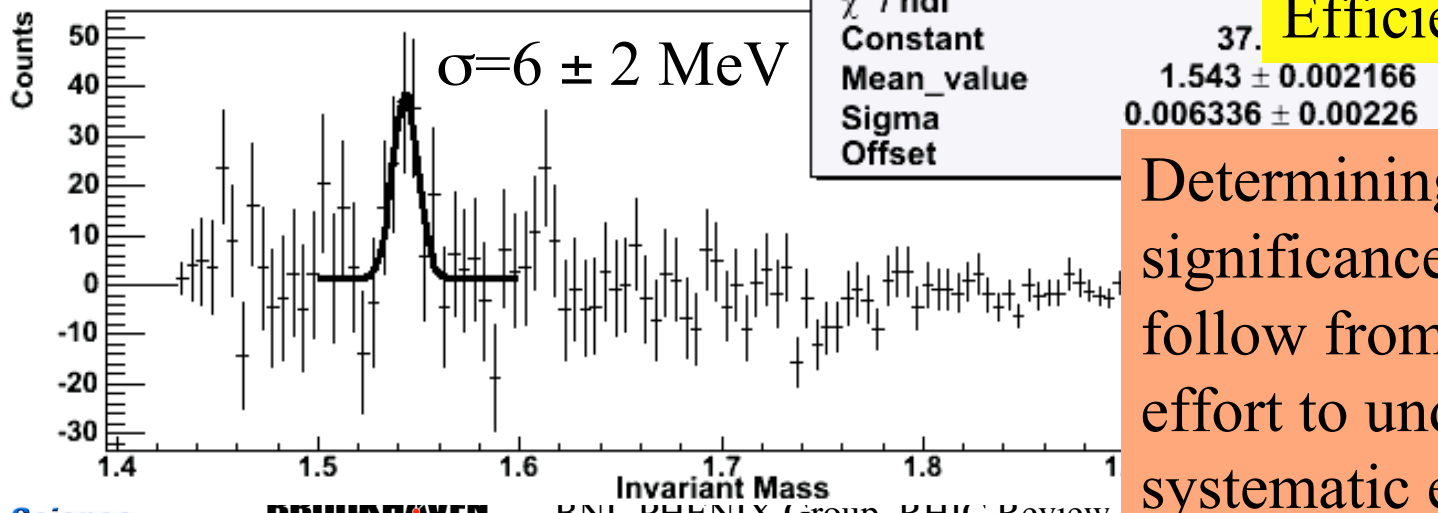
DO's data-processing record: **The researchers are using the Grid to reprocess threeyears' worth of data - 1000 million particle collisions - in six months.**

- Run 5: We recorded 2B Cu+Cu processed them; we processed 1B Au+Au from run 4; we recorded 2B more p-p---at the same time; and also transferred them to Japan (260TB)!

Anti Penta Quarks with PHENIX?
First case of withdrawing a Pentaquark

$\bar{\Theta}^- \rightarrow \bar{n} + K^-$





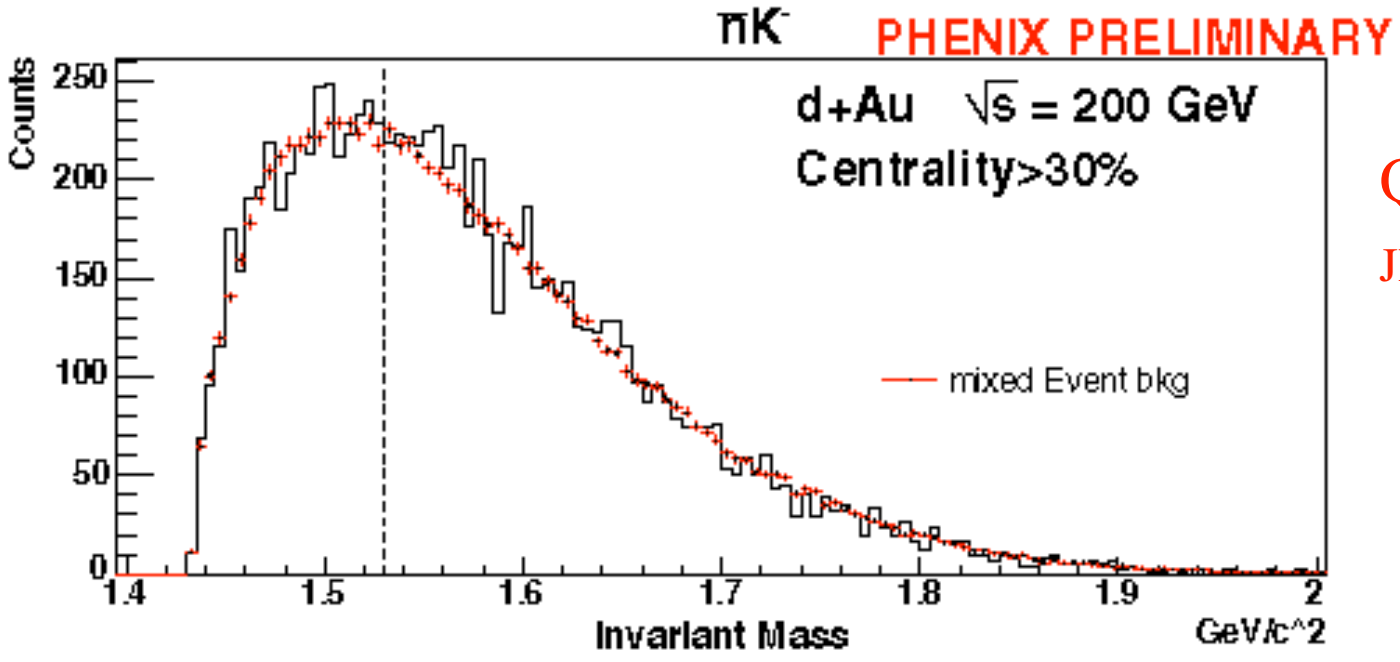
Statistically it's a 4σ effect

No estimate of systematic Error yet

No estimate of Efficiency yet

Determining statistical significance of peak will follow from the ongoing effort to understand the systematic errors

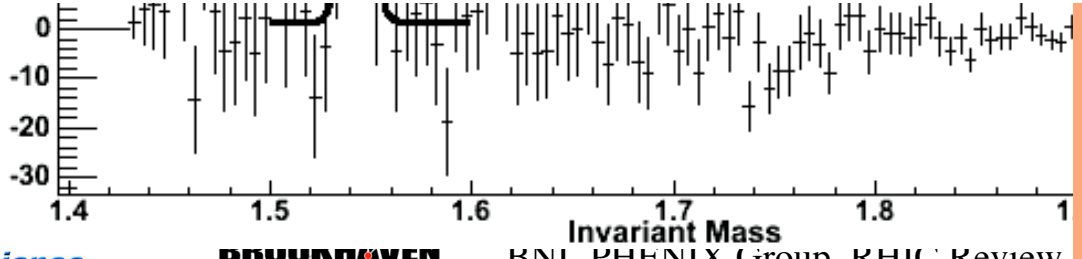
Anti Penta Quarks with PHENIX?
First case of withdrawing a Pentaquark



QM2004 proc

JPG **30** (2004) S1201

Figure 5. $K^- \overline{n}$ invariant mass distribution. No enhancement is visible at the $\overline{\Theta}^-$ mass after the necessary timing correction is applied.



significance of peak will follow from the ongoing effort to understand the systematic errors

Centrality & Total Cross Section

Belikov, Milov, Morrison, White

- Need Cu+Cu 22, 62.4, 200 GeV, Au+Au 62.4 GeV
- **Precision takes longer**
  - Disagreement between BBC calibration p-p Run 2, 3
  - d+Au centrality bias--correlation central arm---BBC
  - New d+Au cross section measurement from photo-disintegration of deuteron
- p-p identified charged hadron p_T distributions disagree run 2 and run 3.

All resolved but delayed dAu and p-p publications---coming soon.

PXWhite paper NuclPhysA**757**(2005)184 --One Big Grape-but the size of a nucleon

H Satz Rep. Prog. Phys. **63** (2000) 1511

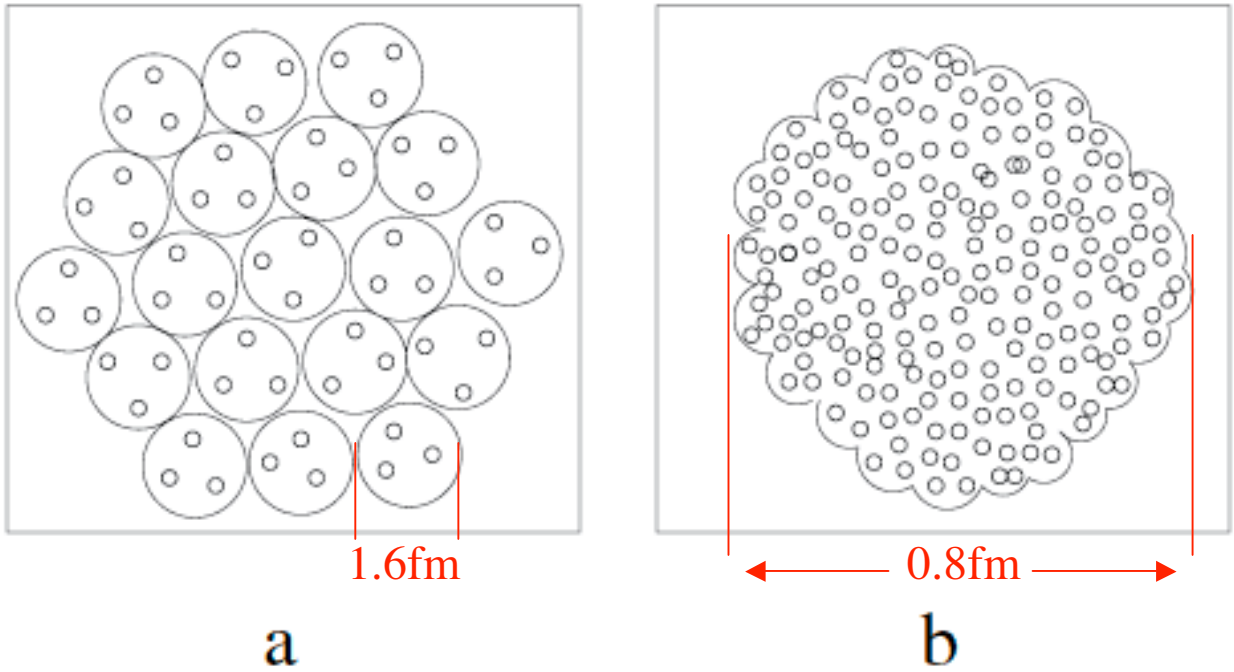
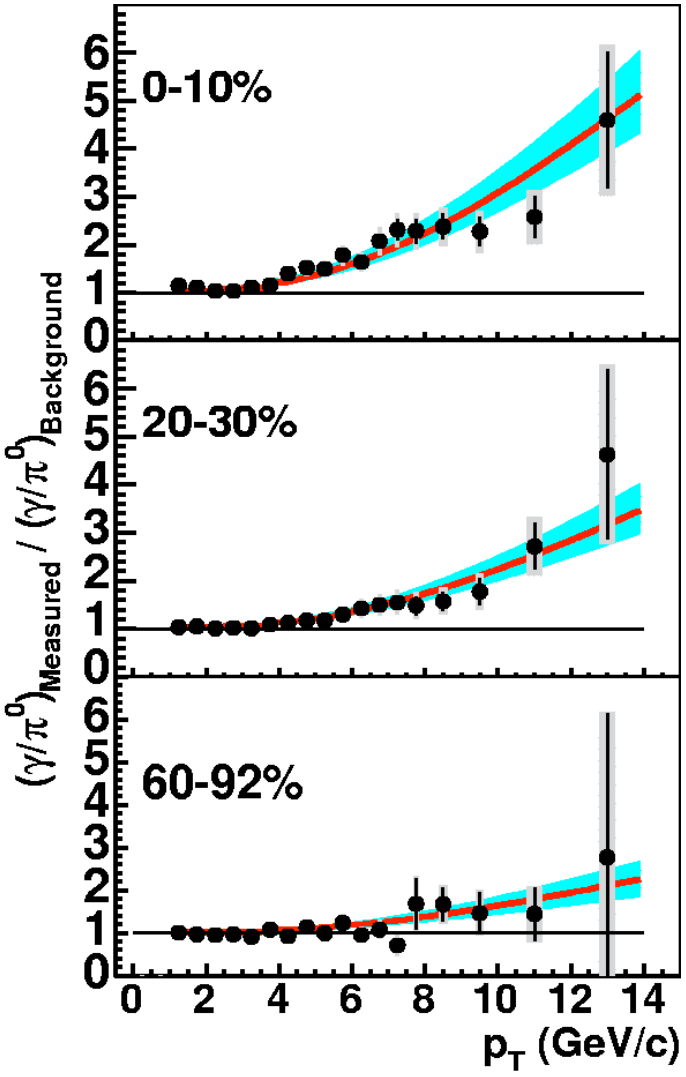
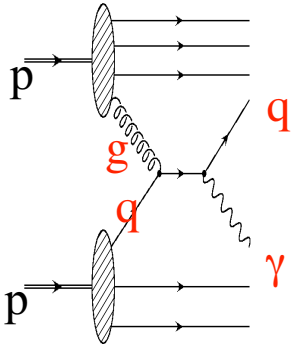


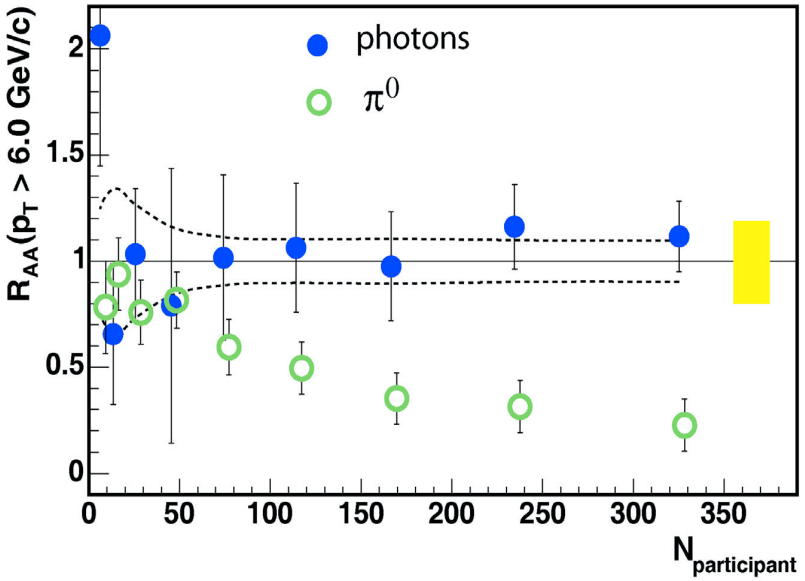
Figure 1. Strongly interacting matter as nuclear matter at a density of closely packed nucleons (*a*) and as quark matter at much higher density (*b*).

Writing: Tannenbaum Internal review: O'Brien Editing: Johnson

Direct Photons in AuAu-Not suppressed





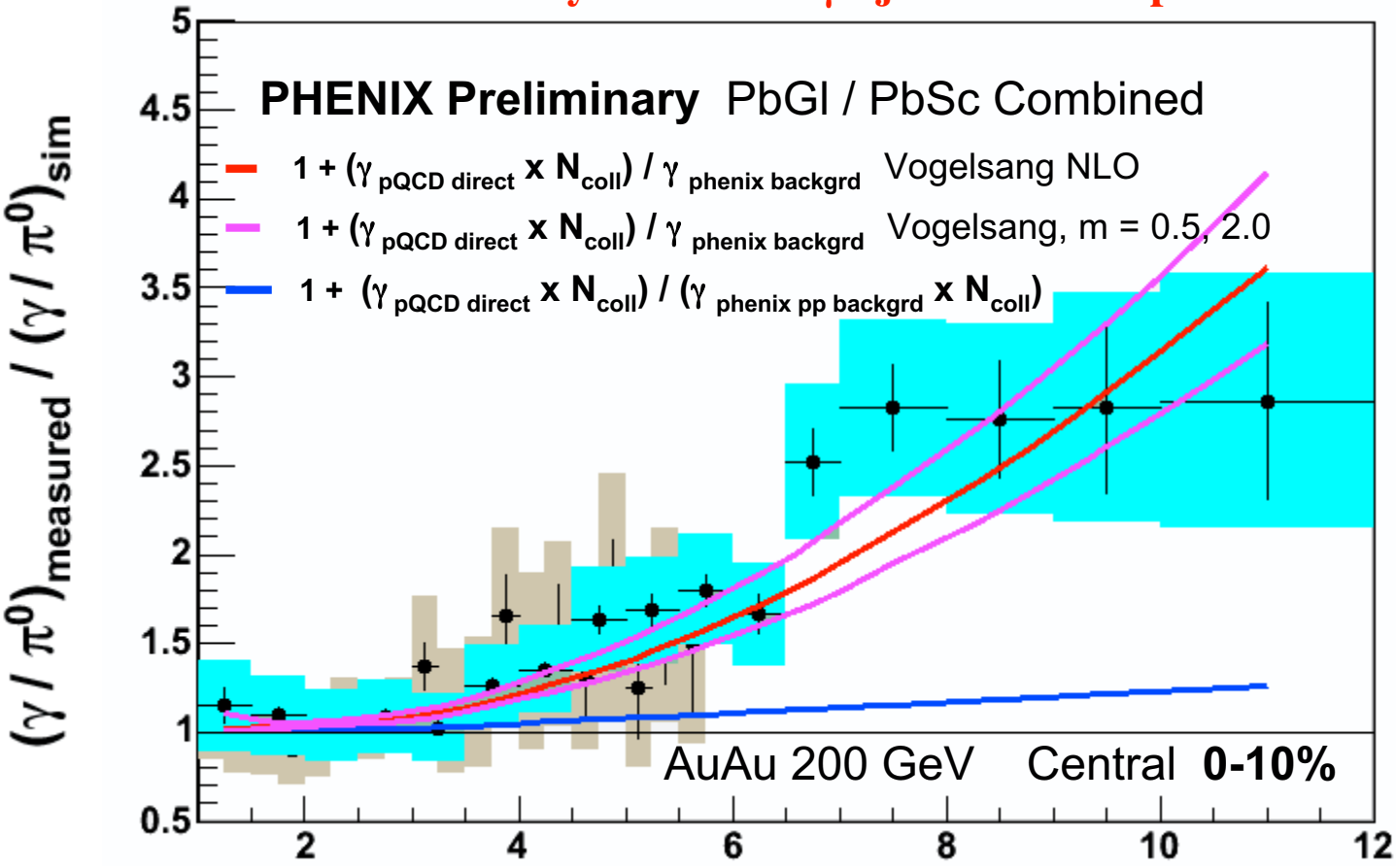


Next: γ+Jet cf π^0 +Jet

Thermal or medium-induced photons are all buried in the systematic error bands around red-line (pQCD) → Improve

Big improvement from QM2004-still working

Need lots more statistics+systematics⇒γ-"jet"+thermal photons+...



Theory curves include PHENIX $\gamma_{\text{expected background}}$ calculation based on π^0:

$$(\gamma_{\text{direct}} + \gamma_{\text{exp. bkgd.}}) / \gamma_{\text{exp. bkgd.}} = 1 + (\gamma_{\text{direct}}/\gamma_{\text{exp. bkgd.}})$$

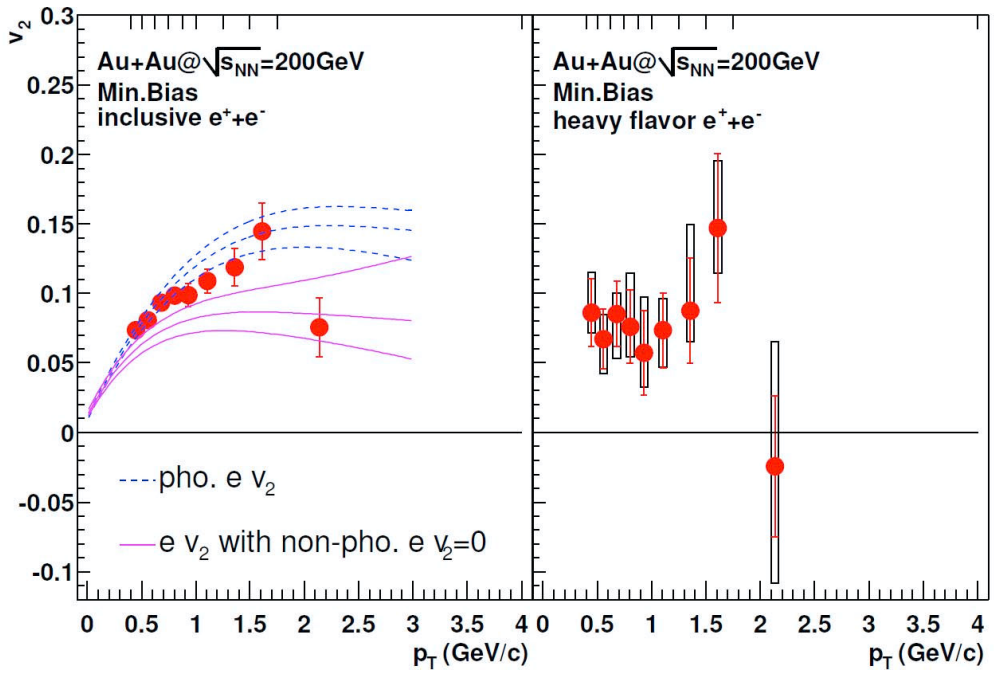
Mid p_T direct γ
Improve Systematic Errors in EMCal

G. David, T. Sakaguchi, H. Bueshing, EMCal group, (TadaAki Isobe)
Calibration, balance, hot/warm towers, run-by-run. background;
converter runs to check what we think are γ convert as expected

- Also vital for: π^0, $e^{\pm}$ cross sections; π^0, γ, $e^{\pm}$ flow; $J/\psi \rightarrow e^+e^-$ etc

nucl-ex-0502009
to appear PRC

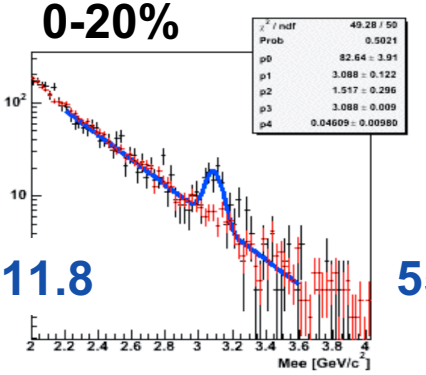
v_2 π^0 γ pending



J/Ψ in Run-4 AuAu

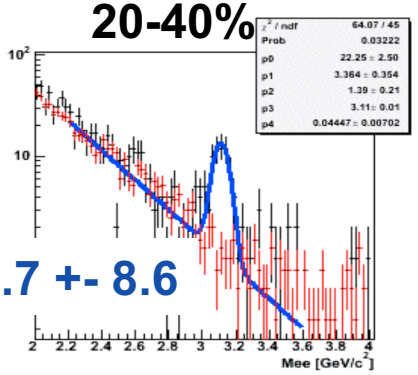
J/Ψ->e^+e^- **(1/3 of data sample)**

0-20%



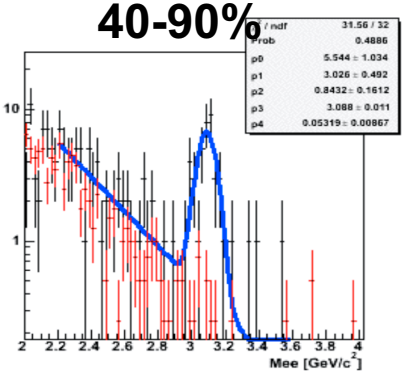
60.6 +- 11.8

20-40%



55.7 +- 8.6

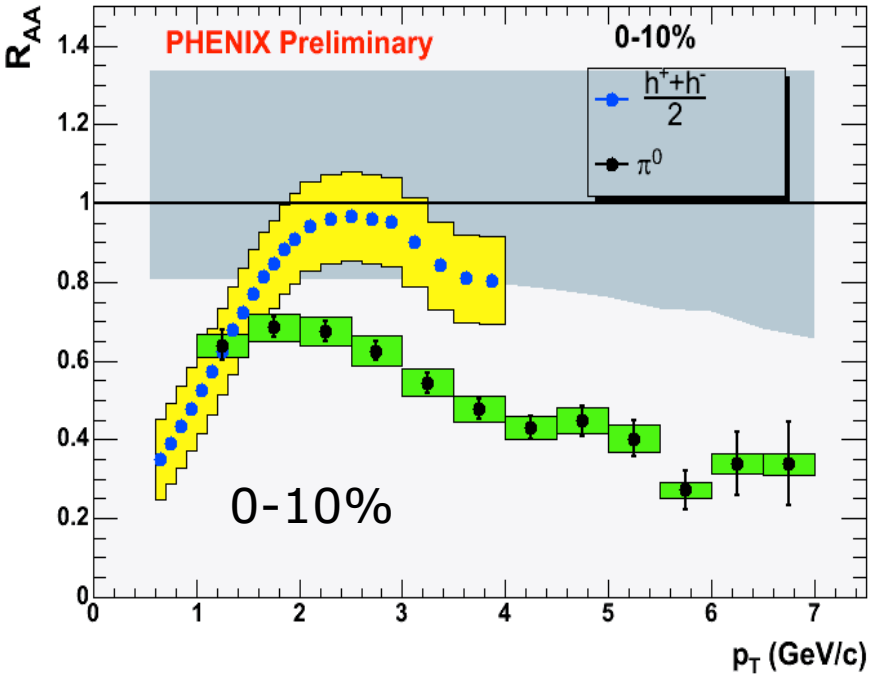
40-90%

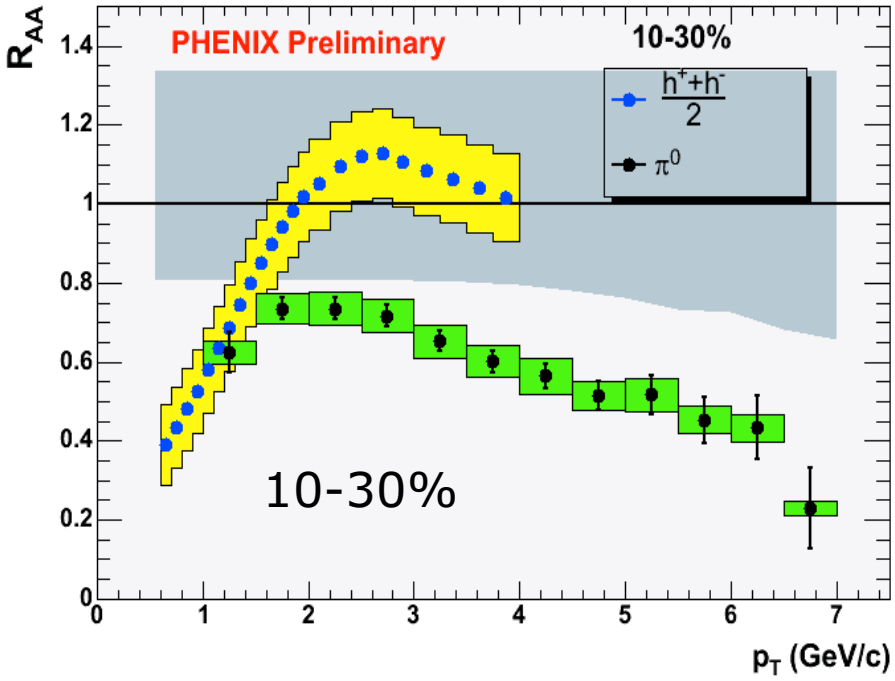


Data production and analysis underway – see you at QM05!

Not enough people to be able to contribute more directly but two of Hamagaki's students: Taku Gunji, Fukutaro Kajihara consult with Takao Sakaguchi (former RICH expert) and ``officially'' responsible to MJT while at BNL.

Au+Au @ 62.4 GeV

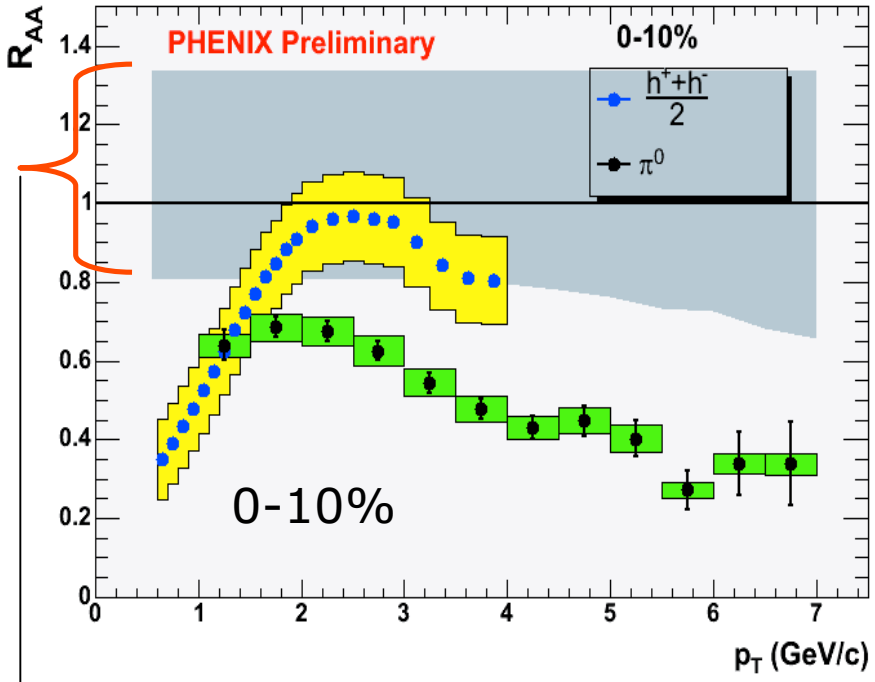


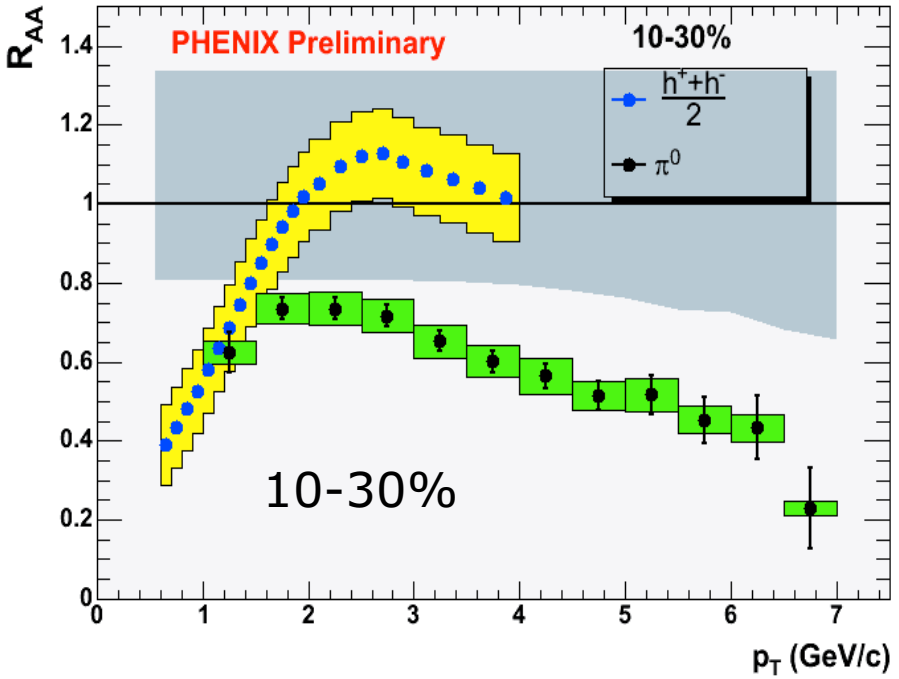


R_{AA} calculated using ISR data for pp reference.

Systematics could be greatly reduced with RHIC pp reference at 62.4 GeV!
My first priority for Run 6!

Au+Au @ 62.4 GeV



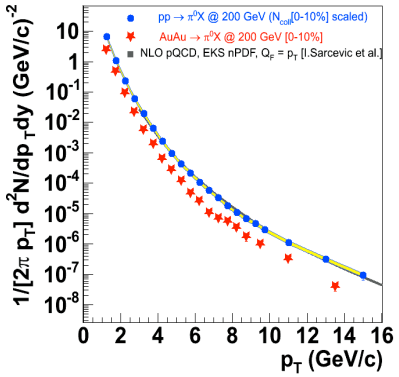


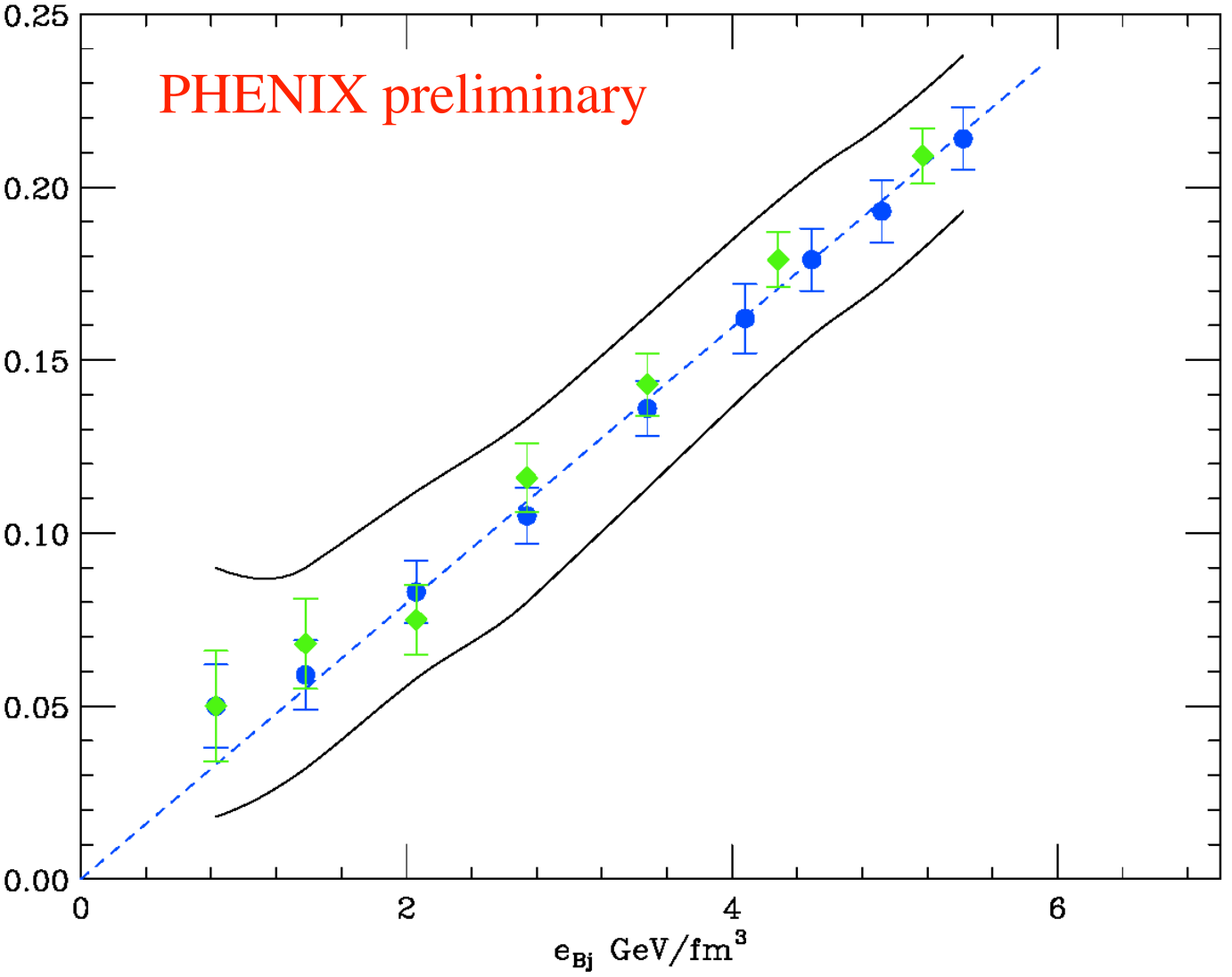
→ **Systematic error due to pp reference**

R_{AA} calculated using ISR data for pp reference.

Systematics could be greatly reduced with RHIC pp reference at 62.4 GeV!
My first priority for Run 6!

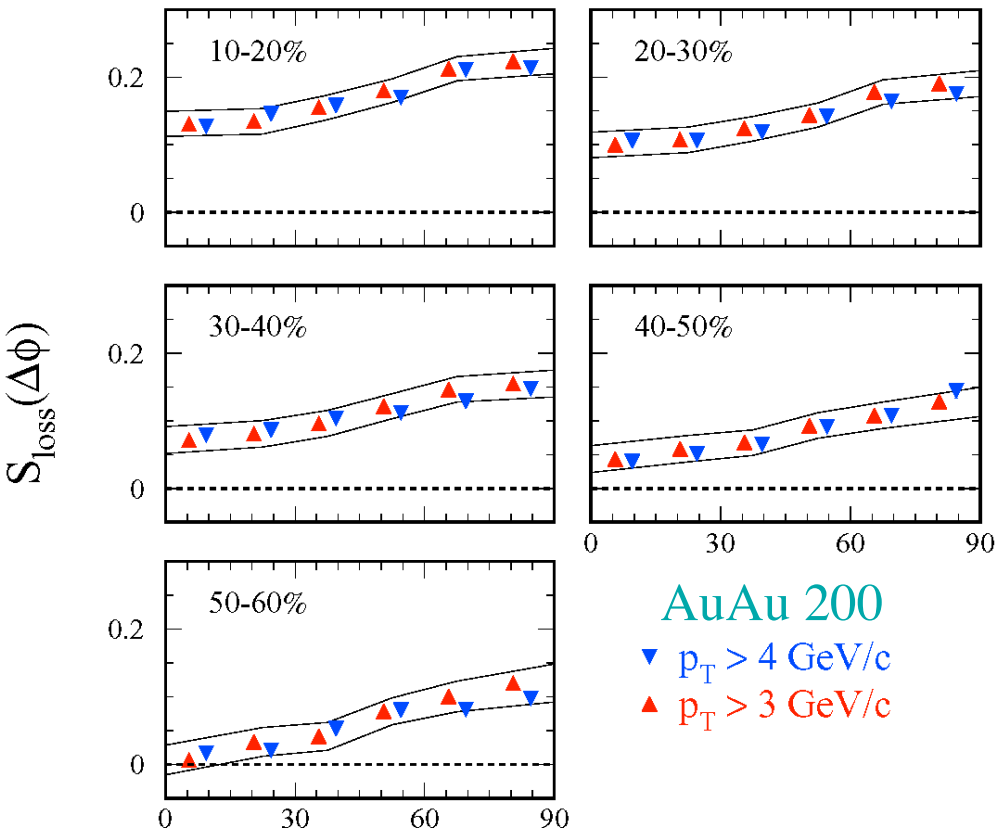
Plot $\Delta E(p_T)/p_T = S_{loss}$ vs centrality $\varepsilon_{Bj}(Npart)$

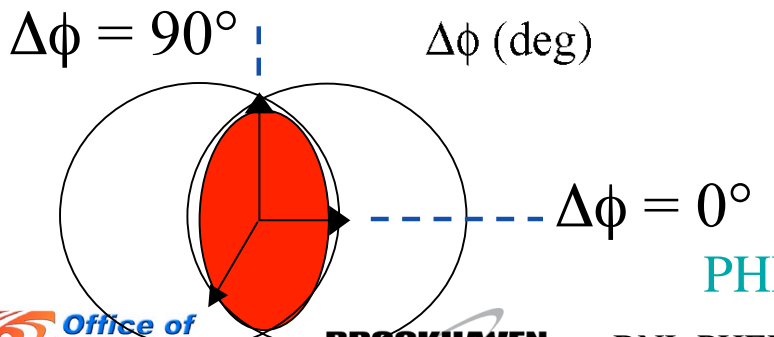




!

R_{AA} (S_{loss}) π^0 vs. Reaction Plane: $\Delta E(/E) \sim \rho L^2$?





- R_{AA} can be calculated as a function of angle w.r.t the reaction plane.
  - ✓ R_{AA} for $\pi 0$ in AuAu
  - ✓ Use R_{AA} to calculate S_{loss} as a function of angle
  - ✓ More detailed information about path length dependence!
- Run-4 data will add:
  - ✓ Higher reach in p_T
  - ✓ The η.
- Run-5 (CuCu) data:
  - ✓ Different density and path length through medium

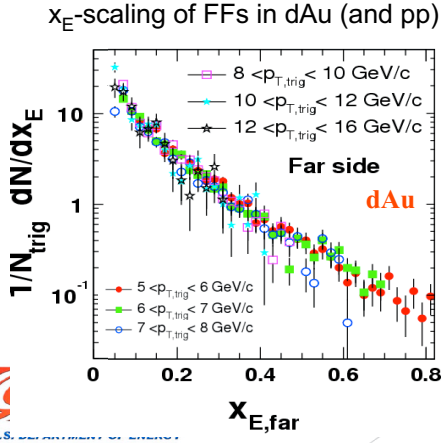
Different systems, different $\sqrt{s}$ different p_T, different particles until we understand medium effect and Energy Loss Theory

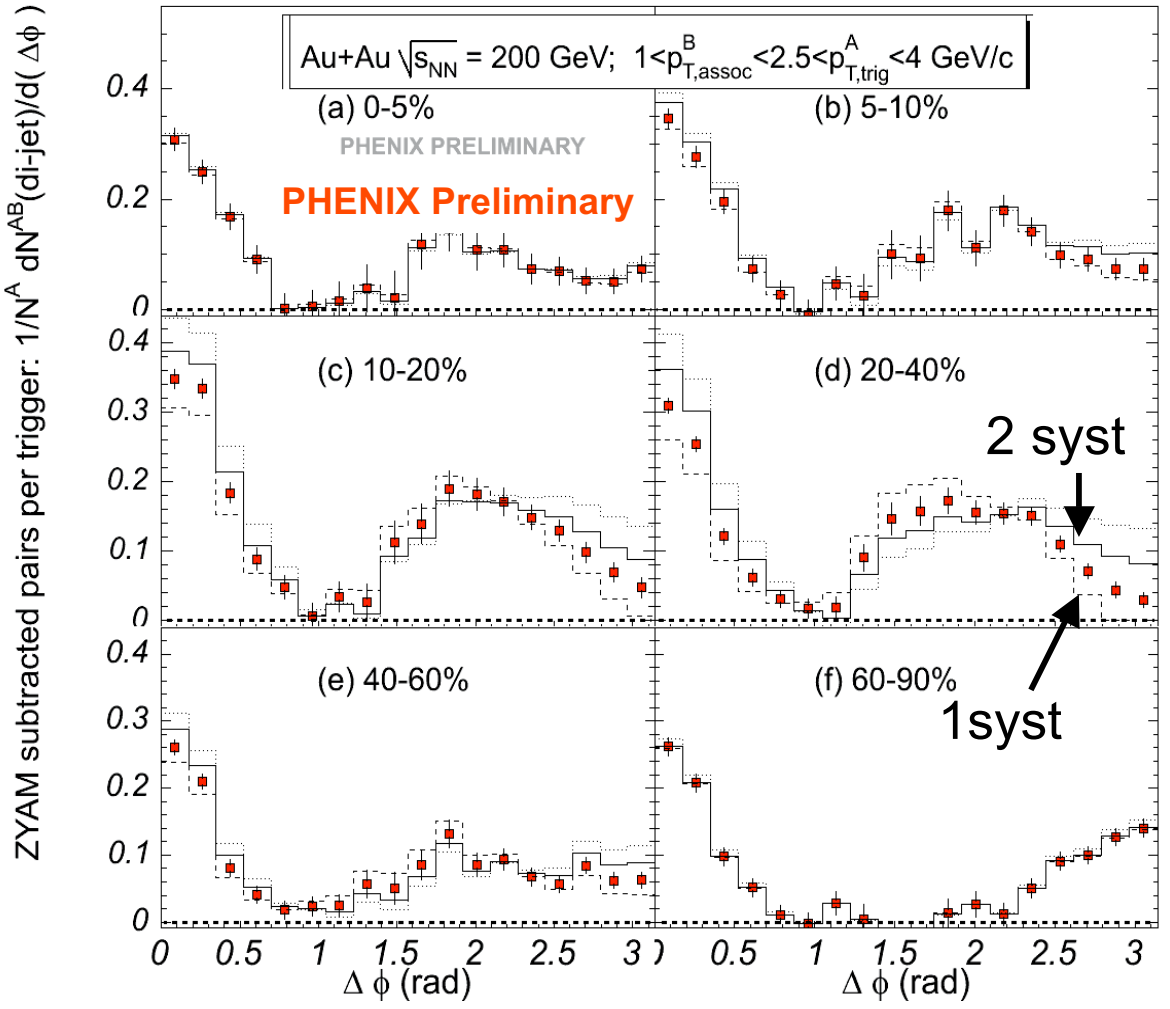
PHENIX Preliminary⇒ Nice Result at QM2005

Jet Structure-2 particle correlations-from CERN-ISR

- Back-angle correlations in AuAu display unusual shape!
  - ✓ Indication of shock wave?
  - ✓ If so this may measure the speed of sound in the medium!
  - ✓ Run-4,5,8 needed to push to higher p_T!
    - Easier to deal with v_2
    - Narrowing correlation peaks

Needs lots more data!

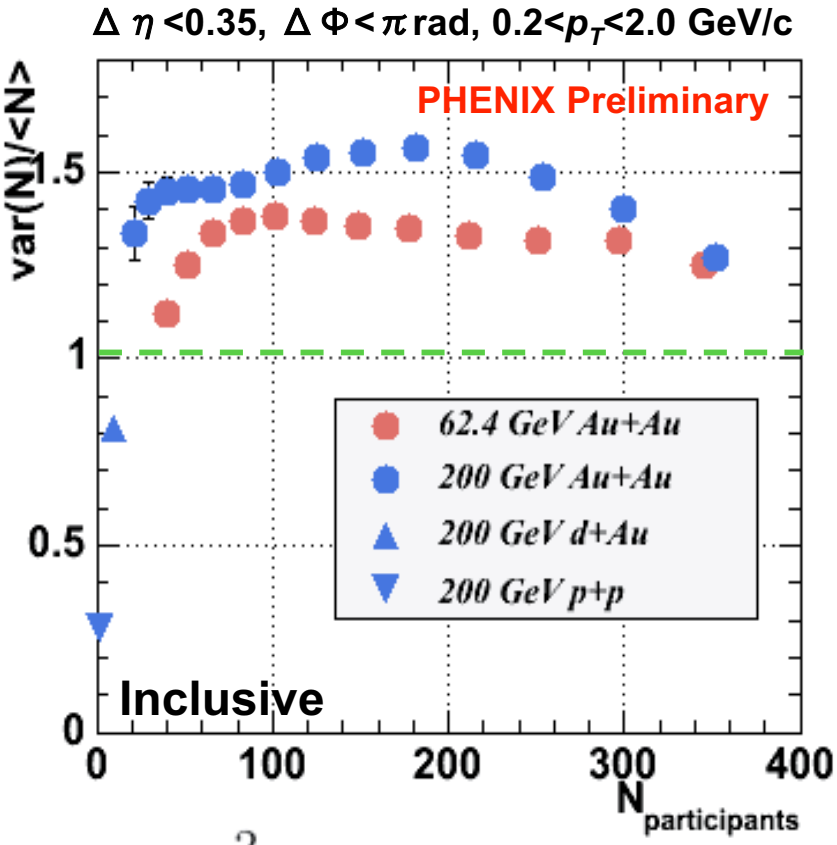




Also j_T, k_T, fragmentation function, in pp dAu at QM2005

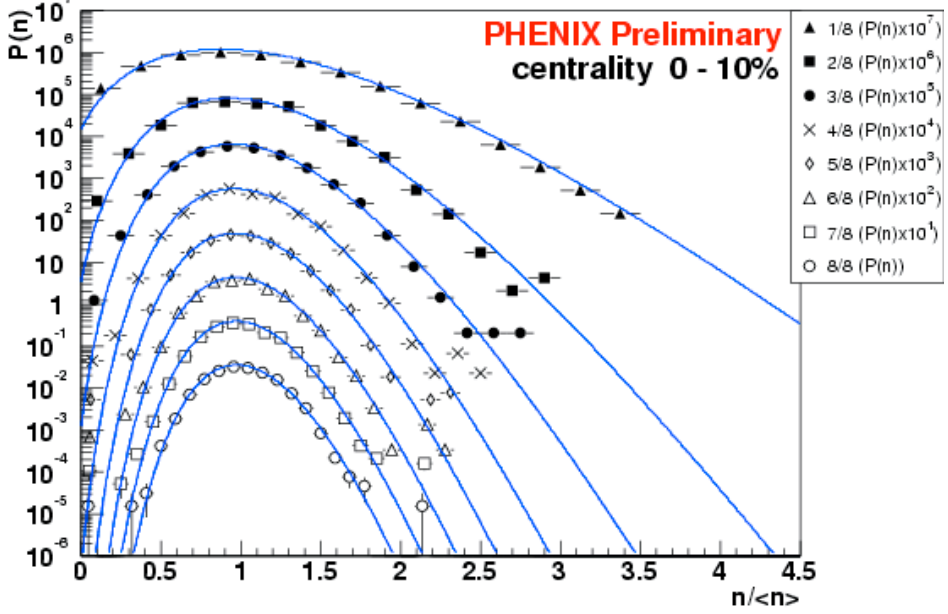
Correlations-Fluctuations

Multiplicity distributions observed in Au+Au, d+Au and p+p collisions at PHENIX also conform to the negative binomial distribution.



$$\frac{\sigma^2}{\mu} = 1 + \frac{\mu}{k}$$

PHENIX: Au+Au $\sqrt{s_{NN}}$=200GeV
NBD fits vs δη



K. Homma and T. Nakamura
+JTM+MJT

LHC-Atlas [BNL-HEP is US center]

- My main job is to keep everybody not thinking about LHC so as to discover everything there is to discover at RHIC
- Our group's contribution is 25% of Sebastian White
  - ZDC
  - Ultra-Peripheral (Coulomb)-``UPC'' physics
  - Special travel budget from Physics Dept funds
- Expect J/Psi measurement in UPC from PHENIX at QM2005 or soon afterwards.

Future Plans-Same for Group and Collaboration

RHIC Physics Beyond the Reach of Current Facility

Provide key measurements so far inaccessible at RHIC in three broad areas:

- **High T QCD (AA, pA, and pp):**
  - Electro magnetic radiation (e^+e^- pair continuum)
  - Heavy flavor (c- and b-production)
  - Jet tomography (jet-jet and γ-jet)
  - Quarkonium (J/ψ, ψ' , χ_c and $\Upsilon(1s)$,$\Upsilon(2s)$,$\Upsilon(3s)$)

  requires highest AA luminosity

- **Spin structure of the nucleon:**
  - Quark spin structure $\Delta q/q$ (W-production)
  - Gluon spin structure $\Delta G/G$ (heavy flavor and γ-jet correlations)

- **Low x phenomena**
  - gluon saturation in nuclei (particle production at forward rapidity)

All measurements require upgrades of detectors and/or RHIC luminosity

ISSUE(S)

Issue-Manpower and current support

- Constant $$$ Flat-Flat budgets from FY02-FY05 can not continue without seriously impacting Group Research (and Operations)

- Increased level of effort would have the benefit of allowing the hiring of 1 or 2 more scientists or post docs which will allow the group to better keep up with the constant stream of data from RHIC while being able to devote some time to maintain their skills, attend seminars and keep up with other developments in the field

- Moving support from Research to Operations can only be a one time correction. As new components are added to PHENIX money for support must increase. Support received by BNL/PHENIX group must be at least at constant effort (rather than constant dollars---flat-flat).

CONCLUSION

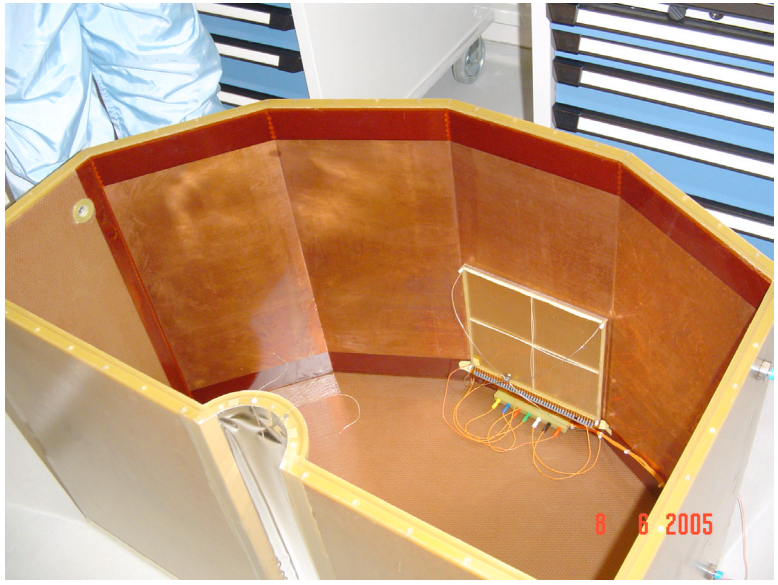
- The BNL PHENIX Group has demonstrated creativity as well as the ability to make high quality measurements of systems ranging from p-p to Au+Au central collisions in the PHENIX detector.
- We wish to continue these successes in order to characterize the hot medium produced at RHIC and to measure its properties using the probes we have successfully demonstrated and mastered (and probably new ones ...)
- We look forward to many more years of great results and discoveries which we will be able to publish as well as to present at national and international meetings.
- Our staff is highly recruited for faculty positions. We would like to be able to maintain or increase (+2 FTE) the present group size.

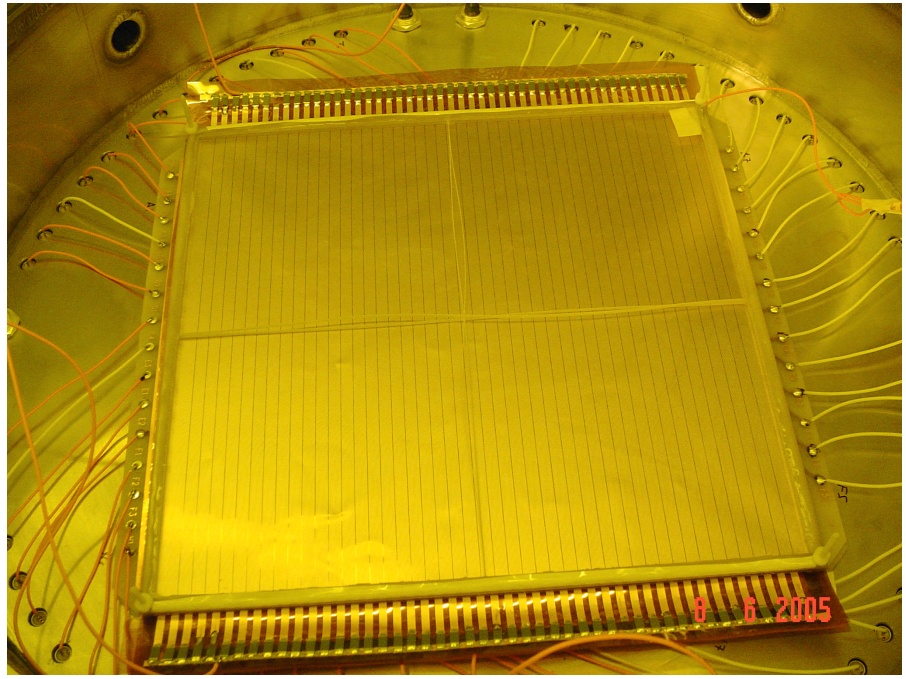
Extra

HBD+inner coil-low mass e^+ e^-

Full Scale Prototype Weizmann

Final GEM foil design frozen
ordering from CERN



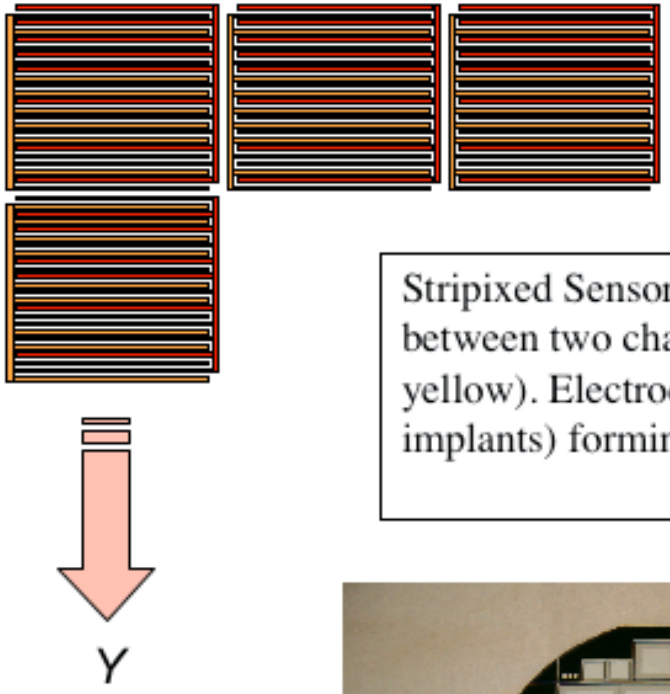


Woody, Milov, Sickles

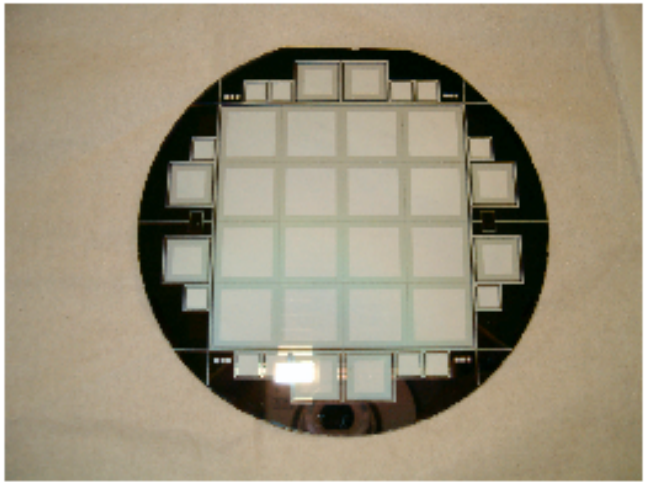
Prototype foil in stainless steel test vessel

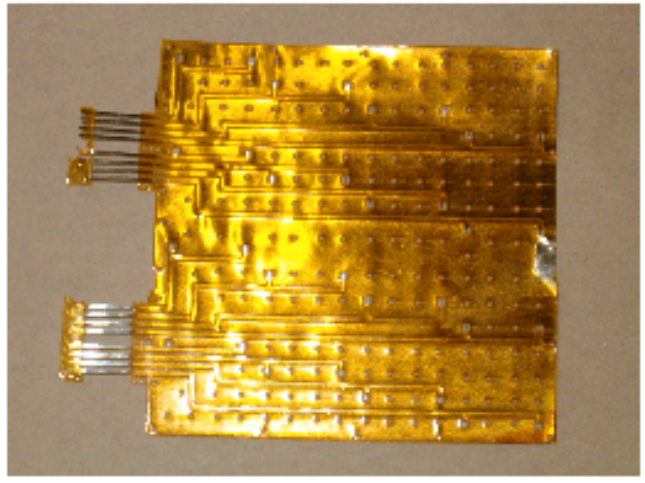
NCC-Prototype

Kistenev has assembled a group of new collaborators from Czech republic and Russia---experts in Silicon



Stripixed Sensor Design: charge collected in the pixel area is shared between two charge collection electrodes each shaped as a comb (red and yellow). Electrodes of the same color are connected (via metallayer or implants) forming two orthogonally oriented strips.





Leadership Positions-Goal ~25%

Rhic-II Science Co-Convenors: S. Mioduszewski High p_T, G. David Electromagnetic Probes.

PHENIX Collaboration Detector Council: O'Brien (head), Haggerty, Morrison, Franz (2), Purschke, White

PHENIX Collaboration Executive Council: O'Brien, Morrison, former, Tannenbaum, White

PHENIX Collaboration Management Group: O'Brien (OPS mgr)

Coordinators: Haggerty (DAQ), Morrison (Computing), Johnson (Office, Pubs, IB-EC(secy)), Pinkenburg (Analysis software Mgr),

PHENIX Collaboration Physics Working Group Convenors : Buesching, Milov. Former: David, Franz, Mioduszewski, Mitchell, Morrison, Tannenbaum, Velkovska, White

QM2005 PHENIX Plenary talk (1/2) Henner Buesching

Students

Raul Armendariz (New Mexico State Univ): Mitchell, Tannenbaum

Cesar da Silva (Sao Paulo): Franz (TEC/TRD)

Robert Vertesi, Jozsef Imrek, Peter Tarjan (Debrecen): David

TadaAki Isobe (CNS): David, Sakaguchi

Taku Gunji, Fukutaro Kajihara (CNS): Tannenbaum, Sakaguchi

PHENIX Focus--weekly lectures to students on PHENIX experiment and physics: Buesching. uBNL-David-reviews PHENIX physics papers with on-site students.

ASAP--Mitchell advisory board

Publications, Talks, Service FY2004

Publications:			
No. of Peer Reviewed Pubs:		No. of Refereed Pubs:	22
No. of Internal Reports:	21	No. of Invited Papers:	1
No. of Books:		No. of Conf Proceedings:	20/57
No. of Seminars:	7	No. of Invited Talks	19
No. of Contributed talks	19		

Service Activity for DOE Program and/or Nat'l/Regional level

- BNL UEC---Brant Johnson (Chair)
- Particle Physics Data Grid---D. Morrison (PHENIX Liason)
- DOE/NSF USLHC Evaluation M&O Group—E.O'Brien
- DOE/NSF Review of US-ATLAS/CMS M&O Program (FNAL) February 2004—E. O'Brien
- DOE/NSF Review of US-ATLAS/CMS Detector Project 'Lehman Review' (FNAL), May 2004—E. O'Brien
- DOE "Lehmann" Review of BTeV April 27-29, 2004—J.S.Haggerty
- DOE Review of DOE-MIT Cooperative Agreement in Nuclear Physics FY05-FY07, MIT, Cambridge, MA, July 27-28, 2004—M.J.Tannenbaum

Publications, Talks, Service FY2004-II

External Advisory Committees

•M. J. Tannenbaum,Conseil Scientifique, Laboratoire LePrince-Ringuet, Ecole Polytechnique, Palaiseau, Paris, France

•C. Woody Chairman of the Radiation Instrumentation Steering Committee (RISC) of the IEEE Nuclear and Plasma Sciences Society

Conference Organizing Committees

•M. Harvey, Post-Doc Committee Member, National Society of Black Physicists and Black Physics Students—Joint Meeting with National Society of Hispanic Physicists, Washington, DC, February 2004.

•J. T. Mitchell, XXXIV International Symposium on Multiparticle Dynamics, Local Organizing Committee

• D. Morrison, RIKEN BNL Research Center Workshop on High p_T Physics at RHIC, December 2-6, 2003.

• C. Pinkenburg, Coorganizer of the workshop "Strangeness and Exotica at RHIC" whichtook place during the Rhic & AGS Users meeting.

• M.L. Purschke, An organizer of the CHEP 2004 conference in Interlaken, Switzerland

• M. J. Tannenbaum, Organizing Committee, Einstein Celebration, NY Academy of Sciences for May 2005

• M. J. Tannenbaum, Organizer Workshop R2b, , RHIC/AGS User's Meeting, May 2004.

• C. Woody, Member of the Program Committee, 2004 IEEE Nuclear Science Symposium and Medical Imaging Conference

Significant Awards:

- Saskia Mioduszewski awarded Presidential Early Career Award for Scientists and Engineers (2003) on September 9, 2004.
- David Morrison (PHENIX) awarded Tenure.
- Craig Woody (PHENIX) Elected Senior Member of the IEEE

Publications 3/2004--6/2005-I

L=leading, C=contributing, S=significant(some), M=minimal *Italics=BNLGroup*

Number	Title	Preparation /Analysis	InternalReview
32S	DiJet correlations AuAu 200	Stankus(ORNL) SB, ISU, Col. *Hard-Photon PWG*	
31C	A_{LL} mid-rapidity π^0 PRL 93, 202002 (2004)	Bazilevsky(RBRC) *BNL π^0 Group*	
30C	PID Centrality d+Au (in prep)	Matthias(SB) *Velkovska, Centrality, PID*	
29L	j_T,k_T,x_E p-p (in prep)	Rak(ISU) *Tannenbaum*	
27L	Event-by-event 200 AuAu PRL 93, 092301 (2004)	*Mitchell(chair) Tannenbaum*	
21S	Bose-Einstein $\pi\pi$ AuAu 200 PRL 93, 152302 (2004)	Enikozono(Hiroshima) *EMCAL TOF*	

Publications 3/2004--6/2005-II

L=leading, C=contributing, S=significant(some), M=minimal *Italics=BNLGroup*

Number	Title	Preparation /Analysis	InternalReview
38S	J/Psi pp dAu	Leitch(LANL) *Centrality*	*comments*
37S	Charm single e pp 200	Butsyk, Averbeck (SB)	*comments*
36S	RdAu fwd backward PRL 94, 082302 (2005)	Zhang(Col) *Centrality*	*Morrison*
35S	Charm single e centrality AuAu PRL 94, 082301 (2005)	Hachiya, Akiba *EMCAL*	*comments*
34S	Identified Correlations AuAu	Ajitnand(SB) *EMCAL TOF*	
33C	Jet Structure Baryon Excess AuAu PRC71 051902(R) (2005)	Jacak (SB) *Franz PID*	*Haggerty*

Publications 3/2004--6/2005-III

L=leading, C=contributing, S=significant(some), M=minimal *Italics=BNLGroup*

Number	Title	Preparation /Analysis	InternalReview
44L	high p_T π^0 centrality dAu	*Buesching(BNL)* *Purschke*	
43S	Cumulant v_2	Issah(SB) *Tannenbaum*	
42L	Dir photon centrality AuAu 200 PRL 94, 232301 (2005)	Awes(ORNL) *David, Sakaguchi*	
41C	high pT charge cent h/π^0 dAu	Pantuev(SB) *Morrison* *BNL π^0 Group*	
40S	v_2 electron Au+Au PRC in press	Sakai EMCAL, v_2 photon	
39C	Jet Structure in dAu companion to 29	Ogilvie (ISU) *See 29*	

Publications 3/2004--6/2005-IV

L=leading, C=contributing, S=significant(some), M=minimal *Italics=BNLGroup*

Number	Title	Preparation /Analysis	InternalReview
50S	Single Spin Transverse pp 200	Aidala(Columbia) *EMCAL*	
49C	Direct γ pp 200 PRD 71, 071102(R) (2005)	*Tannenbaum, EMCAL* Reygers(Munster)	
48L	White Paper NPA 757, 184 (2005)	Akiba(Riken) *Tannenbaum*	*O'Brien Johnson*
47S	v_2 saturation 62.4 200 AuAu PRL 94, 232302 (2005)	Lacey(SB) *Tannenbaum*	
46L	v_2 π^0 γ AuAu 200	Esumi (Tsukuba) *Mioduszewski, Kistenev*	
45L	PID charged Hadron pp 200	*Harvey(BNL)* *Tannenbaum*	

Publications 3/2004--6/2005-V

L=leading, C=contributing, S=significant(some), M=minimal *Italics=BNLGroup*

Number	Title	Preparation /Analysis	InternalReview
54L	High p_T π^0 R_{AA} v_2 S_{loss} AuAu	Frantz(Col-SB) *Mioduszewski* *Tannenbaum* *EMCAL*	
53S	$\varphi \rightarrow ee$, KK dAu pp 200	Pal(Vanderbilt) *EMCAL, EMCAL-TOF*	
52M	2 pion Source Imaging AuAu	Lacey(SB)	
51L	High p_T η pp dAu AuAu 200	d'Enterria(Columbia) *Buesching,* *Mioduszewski* *EMCAL*	

PHENIX Operations Budget History

- All numbers in at year dollars.
- R&D funds are not shown

2002 (in k$)		2003 (in k$)		2004 (in k$)		Projected 2005 (in k$)	
3,359	Labor	3,460	Labor	3,668	Labor	4,027	Labor
2,048	Gen Ops	1,834	Gen Ops	1,707	Gen Ops	1,444	Gen Ops
367	Vis Support	337	Vis Support	319	Vis Support	320	Vis
141	Japanese Vis	220	Japanese Vis	198	Japanese Vis	130	Japanese Vis
9	Travel	3	Travel	17	Travel	9	Travel
5,924	Total	5,854	Total	5,909	Total	5,930	Total