PHENIX
Beam Use Proposal

W.A. Zajc
for the PHENIX Collaboration

(this talk available at http://www.phenix.bnl.gov/phenix/WWW/publish/zajc/sp/presentations/RBUP04/)

PHENIX

Brazil	University of São Paulo, São Paulo
China	Academia Sinica, Taipei, Taiwan
	China Institute of Atomic Energy, Beijing
	Peking University, Beijing
France	LPC, University de Clermont-Ferrand, Clermont-Ferrand
	Dapnia, CEA Saclay, Gif-sur-Yvette
	IPN-Orsay, Universite Paris Sud, CNRS-IN2P3, Orsay
	LLR, Ecòle Polytechnique, CNRS-IN2P3, Palaiseau
	SUBATECH, Ecòle des Mines at Nantes, Nantes
Germany	University of Münster, Münster
Hungary	Central Research Institute for Physics (KFKI), Budapest
	Debrecen University, Debrecen
	Eötvös Loránd University (ELTE), Budapest
India	Banaras Hindu University, Banaras
	Bhabha Atomic Research Centre, Bombay
Israel	Weizmann Institute, Rehovot
Japan	Center for Nuclear Study, University of Tokyo, Tokyo
	Hiroshima University, Higashi-Hiroshima
	KEK, Institute for High Energy Physics, Tsukuba
	Kyoto University, Kyoto
	Nagasaki Institute of Applied Science, Nagasaki
	RIKEN, Institute for Physical and Chemical Research, Wako
	RIKEN-BNL Research Center, Upton, NY
	University of Tokyo, Bunkyo-ku, Tokyo
	Tokyo Institute of Technology, Tokyo
	University of Tsukuba, Tsukuba
	Waseda University, Tokyo
S. Korea	Cyclotron Application Laboratory, KAERI, Seoul
	Kangnung National University, Kangnung
	Korea University, Seoul
	Myong Ji University, Yongin City
	System Electronics Laboratory, Seoul Nat. University, Seoul
	Yonsei University, Seoul
Russia	Institute of High Energy Physics, Protovino
	Joint Institute for Nuclear Research, Dubna
	Kurchatov Institute, Moscow
	PNPI, St. Petersburg Nuclear Physics Institute, St. Petersburg
	St. Petersburg State Technical University, St. Petersburg
Sweden	Lund University, Lund

12 Countries; 57 Institutions; 460 Participants*

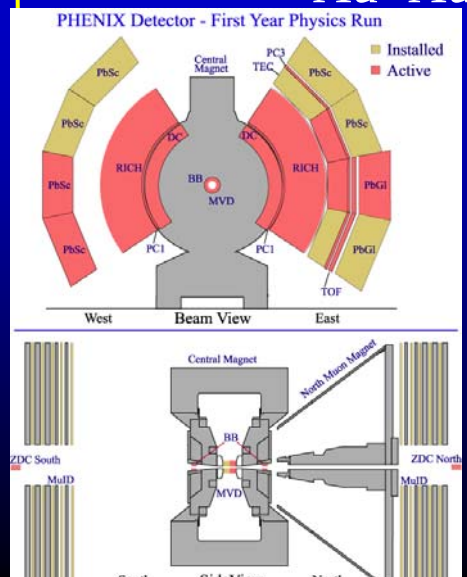
USA	Abilene Christian University, Abilene, TX
	Brookhaven National Laboratory, Upton, NY
	University of California - Riverside, Riverside, CA
	University of Colorado, Boulder, CO
	Columbia University, Nevis Laboratories, Irvington, NY
	Florida State University, Tallahassee, FL
	Georgia State University, Atlanta, GA
	University of Illinois Urbana Champaign, Urbana-Champaign, IL
	Iowa State University and Ames Laboratory, Ames, IA
	Los Alamos National Laboratory, Los Alamos, NM
	Lawrence Livermore National Laboratory, Livermore, CA
	University of New Mexico, Albuquerque, NM
	New Mexico State University, Las Cruces, NM
	Dept. of Chemistry, Stony Brook Univ., Stony Brook, NY
	Dept. Phys. and Astronomy, Stony Brook Univ., Stony Brook, NY
	Oak Ridge National Laboratory, Oak Ridge, TN
	University of Tennessee, Knoxville, TN
	Vanderbilt University, Nashville, TN

*as of July 2002

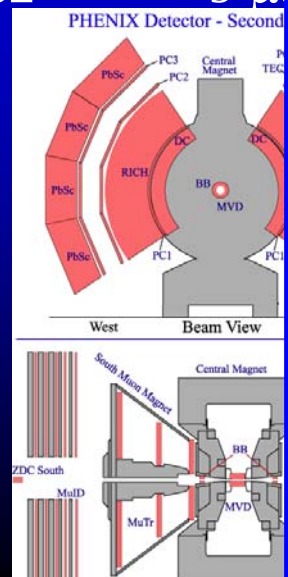
Run-1 to Run-4 Capsule History

Run	Year	Species	$s^{1/2}$ [GeV]	∫Ldt	N_{tot}	p-p Equivalent	Data Size
01	2000	Au+Au	130	1 μb^{-1}	10M	0.04 pb^{-1}	3 TB
02	2001/2002	Au+Au	200	24 μb^{-1}	170M	1.0 pb^{-1}	10 TB
		p+p	200	0.15 pb^{-1}	3.7G	0.15 pb^{-1}	20 TB
03	2002/2003	d+Au	200	2.74 nb^{-1}	5.5G	1.1 pb^{-1}	46 TB
		p+p	200	0.35 pb^{-1}	6.6G	0.35 pb^{-1}	35 TB
04	2003/2004	Au+Au	200	241 μ			
		Au+Au	62	9 μ			

Run-1



Run-2



PHENIX Successes (to date) based on ability to deliver physics at ~all scales:

barn : Multiplicity (Entropy)

millibarn: Flavor yields (temperature)

microbarn: Charm (transport)

nanobarn: Jets (density)

picobarn: J/Psi (deconfinement ?)

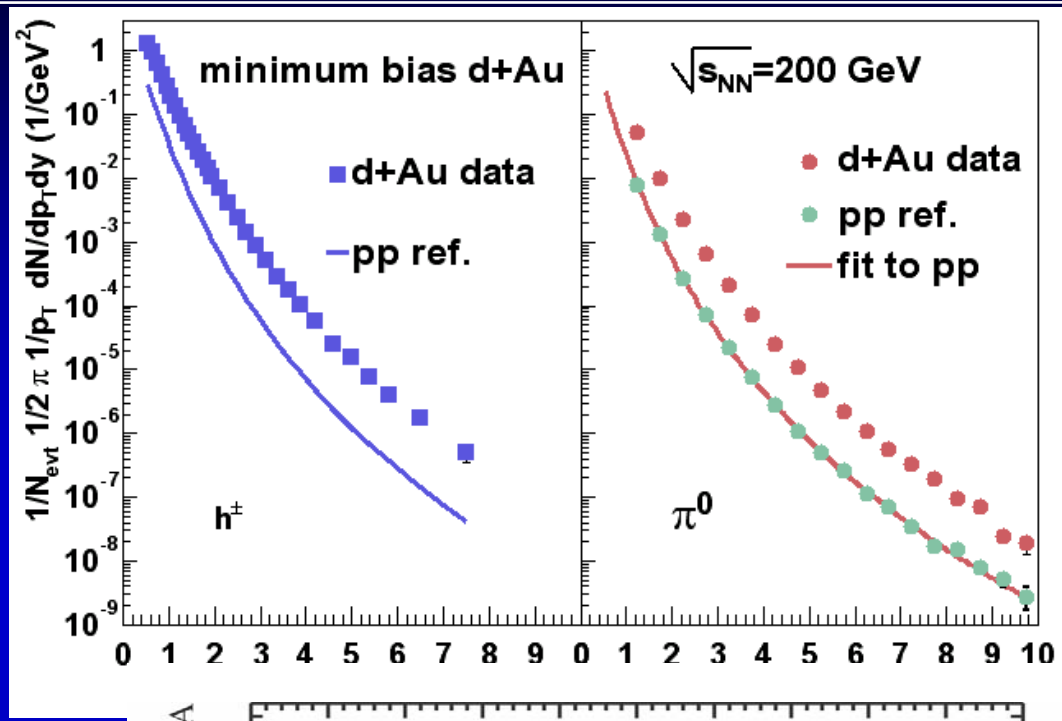
Run-1 Publications

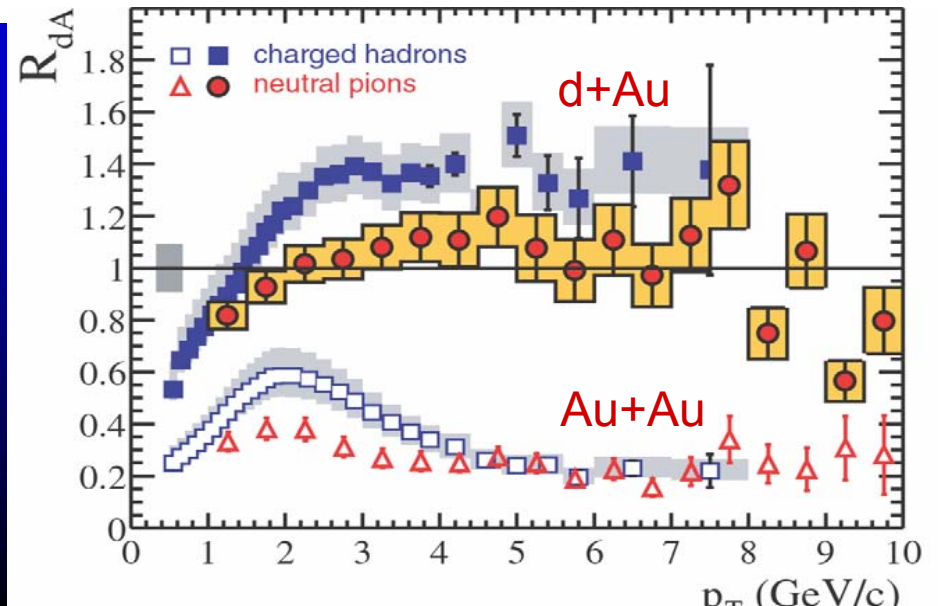
- "Centrality dependence of charged particle multiplicity in Au-Au collisions at $\sqrt{s_{NN}}$ = 130 GeV", PRL 86 (2001) 3500
- "Measurement of the midrapidity transverse energy distribution from $\sqrt{s_{NN}}$ = 130 GeV Au-Au collisions at RHIC", PRL 87 (2001) 052301
- "Suppression of hadrons with large transverse momentum in central Au-Au collisions at $\sqrt{s_{NN}}$ = 130 GeV", PRL 88, 022301 (2002).
- "Centrality dependence of $\pi^{+/-}$, $K^{+/-}$, p and pbar production at RHIC," PRL 88, 242301 (2002).
- "Transverse mass dependence of the two-pion correlation for Au+Au collisions at $\sqrt{s_{NN}}$ = 130 GeV", PRL 88, 192302 (2002)
- "Measurement of single electrons and implications for charm production in Au+Au collisions at $\sqrt{s_{NN}}$ = 130 GeV", PRL 88, 192303 (2002)
- "Net Charge Fluctuations in Au+Au Interactions at $\sqrt{s_{NN}}$ = 130 GeV," PRL. 89, 082301 (2002)
- "Event-by event fluctuations in Mean p_T and mean e_T in sqrt(s_NN) = 130GeV Au+Au Collisions" Phys. Rev. C66, 024901 (2002)
- "Flow Measurements via Two-particle Azimuthal Correlations in Au + Au Collisions at $\sqrt{s_{NN}}$ = 130 GeV" , PRL 89, 212301 (2002)
- "Measurement of the lambda and lambda^bar particles in Au+Au Collisions at $\sqrt{s_{NN}}$ =130 GeV", PRL 89, 092302 (2002)
- "Centrality Dependence of the High pT Charged Hadron Suppression in Au+Au collisions at $\sqrt{s_{NN}}$ = 130 GeV", Phys. Lett. B561, 82 (2003)
- "Single Identified Hadron Spectra from $\sqrt{s_{NN}}$ = 130 GeV Au+Au Collisions", to appear in Physical Review C, nucl-ex/0307010

Run-3 Publications

- "Absence of Suppression in Particle Production at Large Transverse Momentum in $\sqrt{s_{NN}}$ = 200 GeV d+Au Collisions", PRL 91, 072303 (2003)

- PID-ed particles (π^0's) out to the highest p_T's PHENIX's unique contribution to the June "press event"





Accomplishments and Discoveries

- First measurement of the dependence of the charged particle pseudo-rapidity density and the transverse energy on the number of participants in Au+Au collisions at $\sqrt{s_{NN}}$ =130 GeV.
- Discovery of high p_T suppression in π^0 and charged particle production in Au+Au collisions at $\sqrt{s_{NN}}$ =130 GeV and a systematic study of the scaling properties of the suppression; extension of these results to much higher transverse momenta in Au+Au collisions at $\sqrt{s_{NN}}$ =200 GeV
- (Co)-Discovery of absence of high p_T suppression in d+Au collisions at s_{NN} =200~GeV.
- Discovery of the anomalously large proton and anti-proton yields at high transverse momentum in Au+Au collisions at $\sqrt{s_{NN}}$ =130 GeV through the systematic study of $\pi^{\pm}$, $K^{\pm}$, $p^{\pm}$ spectra; measurement of Λ and anti-Λ in Au+Au collisions at $\sqrt{s_{NN}}$ =130 GeV ; study of the scaling properties of the proton and anti-proton yields in Au+Au collisions at $\sqrt{s_{NN}}$ =200 GeV.
- Measurement of HBT correlations in $\pi^+\pi^+$ and $\pi^-\pi^-$ pairs in Au+Au collisions at $\sqrt{s_{NN}}$ =130 GeV , establishing the ``HBT puzzle'' of $R_{OUT} \sim R_{SIDE}$ extends to high pair momentum; extension of these results to $\sqrt{s_{NN}}$ = 200 GeV
- First measurement of single electron spectra in Au+Au collisions at $\sqrt{s_{NN}}$ =130~GeV, suggesting that charm production scales with the number of binary collisions.
- Sensitive measures of charge fluctuations and fluctuations in mean p_T and transverse energy per particle in Au+Au collisions at at $\sqrt{s_{NN}}$ =130~GeV.
- Measurements of elliptic flow for charged particles from Au+Au collisions at $\sqrt{s_{NN}}$ =130~GeV and identified charged hadrons from Au+Au collisions at $\sqrt{s_{NN}}$ =200~GeV.
- Extensive study of hydrodynamic flow, particle yields, ratios and spectra from Au+Au collisions at $\sqrt{s_{NN}}$ =130 GeV and 200 GeV.
- First observation of J/Ψ production in Au+Au collisions at $\sqrt{s_{NN}}$ =200~GeV.
- Measurement of crucial baseline data on π^0 spectra and J/Ψ production in p+p collisions at $\sqrt{s_{NN}}$ =200~GeV.

Beam Use Proposal

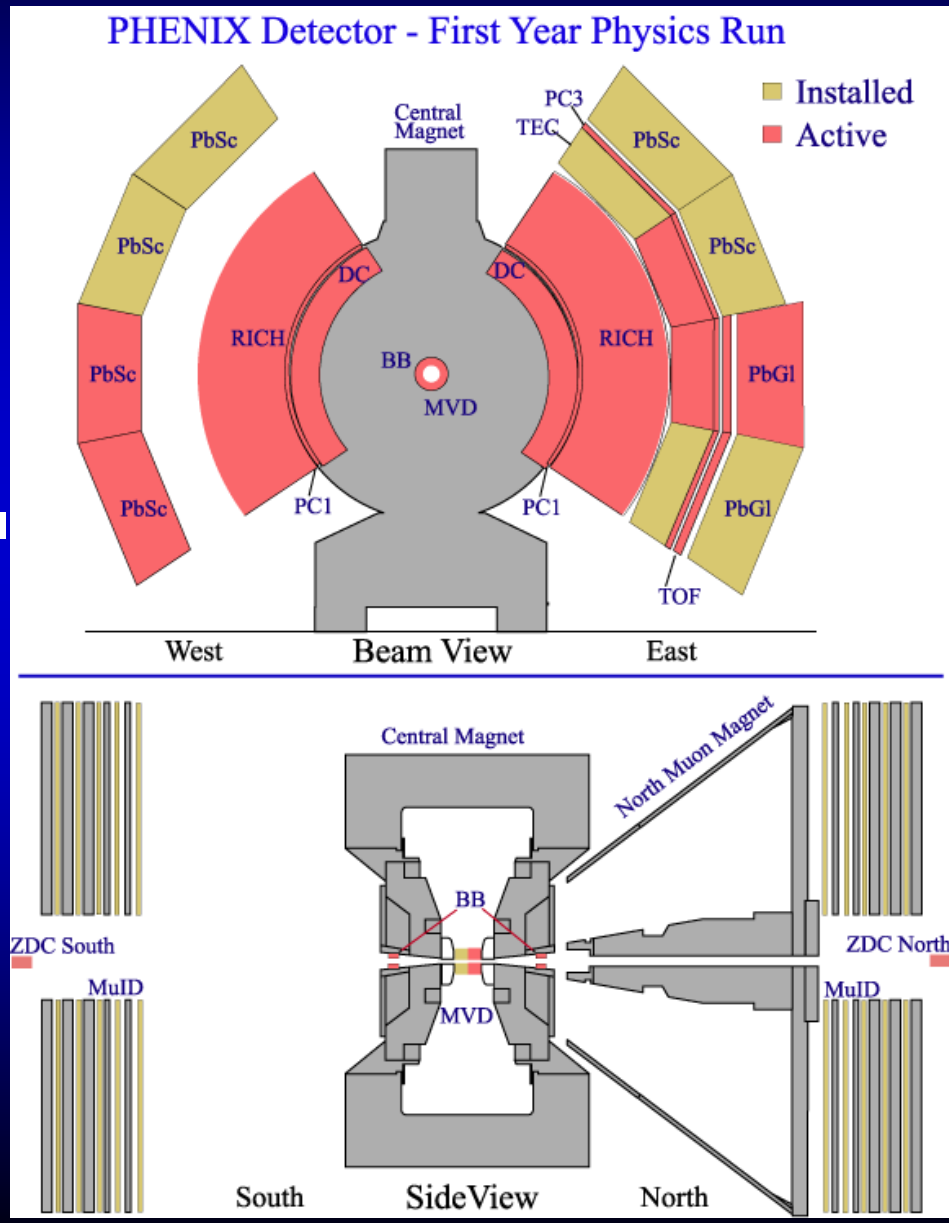
Requested input:

- Desired "beam run segments"
- Physics from same
- Investigate "27" and "31" week scenarios
- Collaboration/experiment status

- **A note on nomenclature:**
  - "Run-1" ≡ Summer-2000 Au+Au run at 130 GeV
  - "Run-2" ≡ 2001/2002 Au+Au/p+p at 200 GeV
  - "Run-3" ≡ 2003 run d+Au/p+p at 200 GeV
  - "Run-4" ≡ 2004 run Au+Au/p+p at 200 GeV

Run-1 Configuration

- Two central arms
  - Mechanically ~complete
  - Roughly half of aperture instrumented
- Global detectors
  - Zero-degree Calorimeters (ZDCs)
  - Beam-Beam Counters (BBCs)
  - Multiplicity and Vertex Detector (MVD, engineering run)



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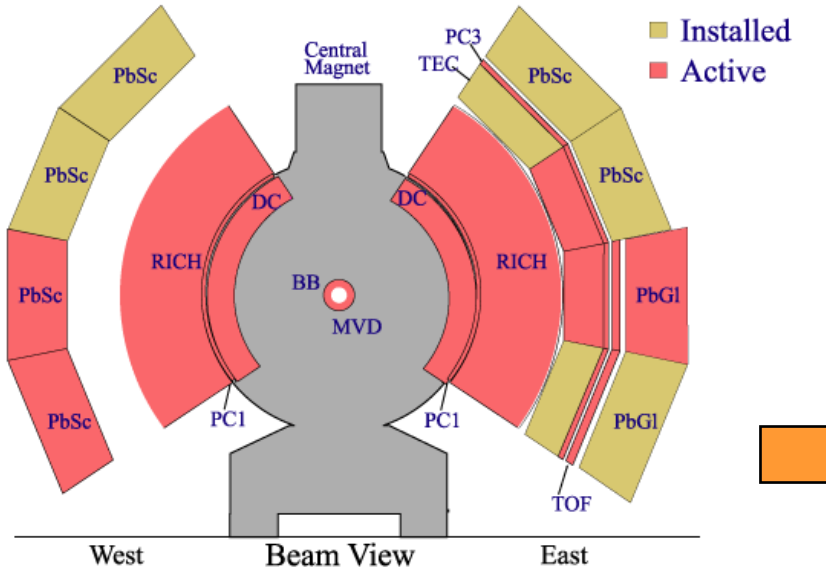
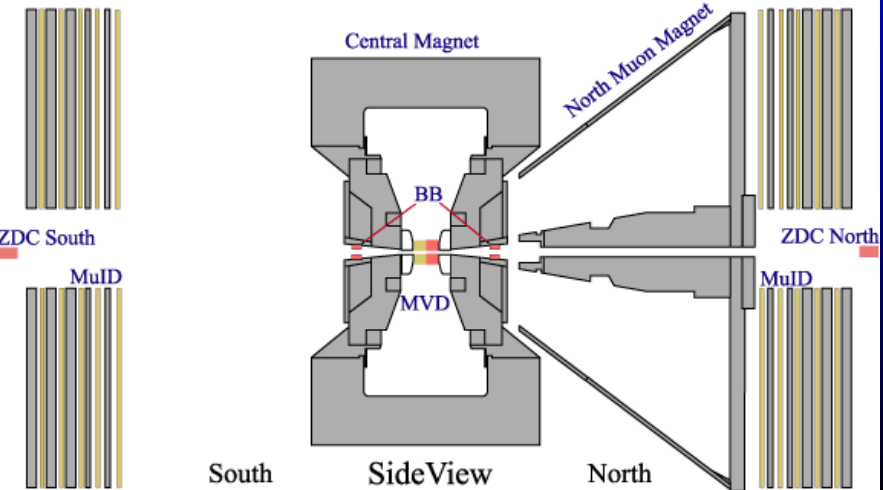
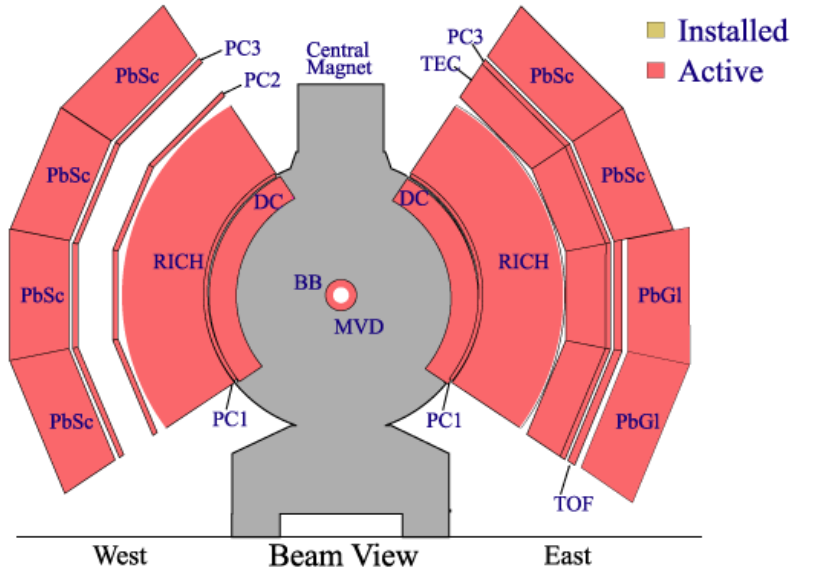
From Run-1 to Run-2

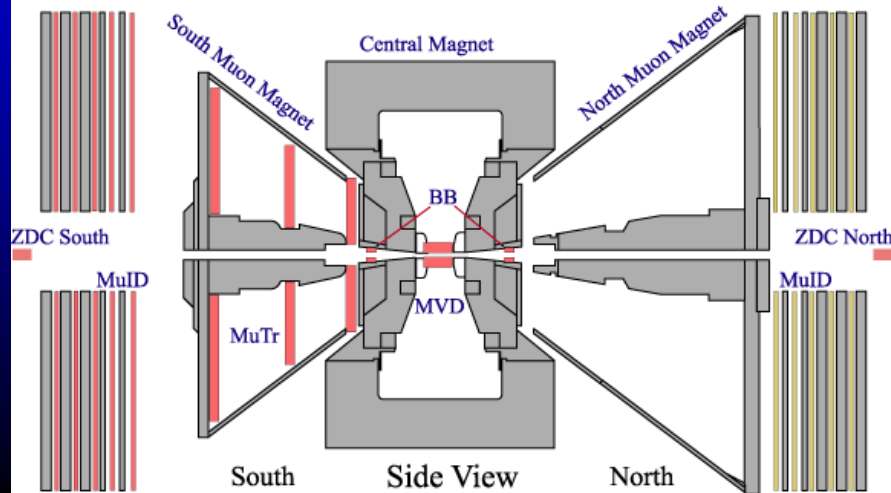
Run-1 (2000)





Run-2 (2001-2)





Run-2 Publications

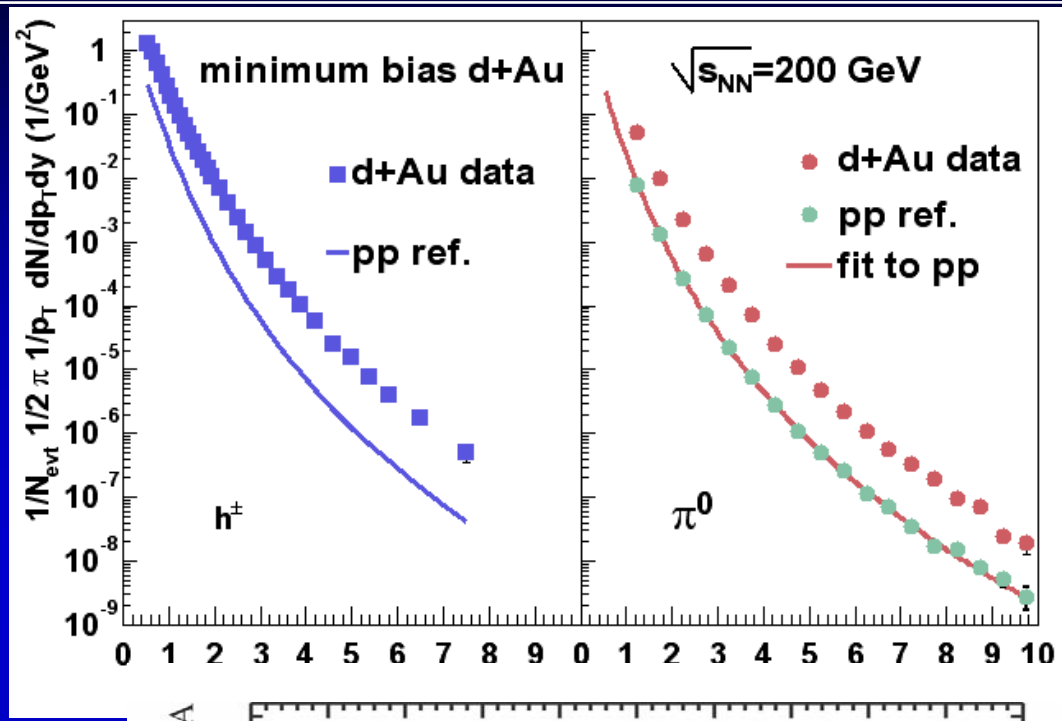
- "Suppressed π^0 Production at Large Transverse Momentum in Central Au+Au Collisions at $\sqrt{s_{NN}}$ = 200 GeV" , Phys. Rev. Lett. 91, 072301 (2003)
- "Scaling Properties of Proton and Anti-proton Production in $\sqrt{s_{NN}}$ = 200 GeV Au+Au Collisions“, Phys. Rev. Lett 91, 172301 (2003).
- "J/Ψ Production in Au-Au Collisions at $\sqrt{s_{NN}}$ =200 GeV at the Relativistic Heavy Ion Collider", Phys. Rev. C 69, 014901 (2004).
- "Elliptic Flow of Identified Hadrons in Au+Au Collisions at $\sqrt{s_{NN}}$ = 200 GeV" , Phys.Rev.Lett. 91 (2003) 182301
- "Midrapidity Neutral Pion Production in Proton-Proton Collisions at $\sqrt{s}$ = 200 GeV“, Phys. Rev. Lett. 91, 241803 (2003)
- "Identified Charged Particle Spectra and Yields in Au-Au Collisions at $\sqrt{s_{NN}}$= 200 GeV", Phys. Rev. C 69, 034909 (2004)
- "J/Ψ production from proton-proton collisions at $\sqrt{s}$ = 200 GeV“, Phys. Rev. Lett. 92, 051802 (2004)
- "High-pt Charged Hadron Suppression in Au+Au Collisions at $\sqrt{s_{NN}}$ = 200 Gev”, Phys. Rev. C 69, 034910 (2004)
- "Measurement of Non-Random Event-by-Event Average Transverse Momentum Fluctuations in $\sqrt{s_{NN}}$ =200 GeV Au+Au Collisions" , S.S. Adler et al., Phys. Rev. Lett. 93, 092301 (2004),
- "Bose-Einstein Correlations of Charged Pion Pairs in Au+Au Collisions at $\sqrt{s_{NN}}$ =200 GeV" to appear in PRL, nucl-ex/0401003
- "Deuteron and anti-deuteron production in Au+Au collisions at \sqrt{s} = 200 GeV" , submitted to PRL June 1, 2004, Preprint: nucl-ex/0406004
- "Identified Leading Particle Correlations in Au+Au and d+Au collisions at $\sqrt{s_{NN}}$ =200 GeV" , submitted to PRL Aug. 7, 2004, nucl-ex/0408007

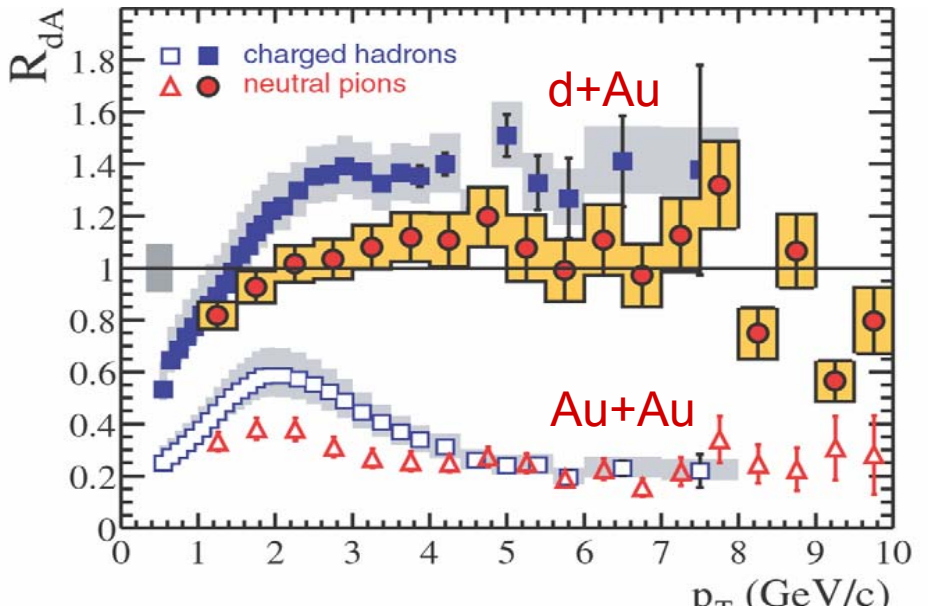
Also contains Run-3 d+Au data

Run-3 Publications

- "Absence of Suppression in Particle Production at Large Transverse Momentum in $\sqrt{s_{NN}}$ = 200 GeV d+Au Collisions", PRL 91, 072303 (2003)

- PID-ed particles (π^0's) out to the highest p_T's PHENIX's unique contribution to June '03 "press event"





First (Run-3) Results on A_{LL}

- First results on $A_{LL}(\pi^0)$:
- "Double Helicity Asymmetry in Inclusive Mid-Rapidity neutral pion Production for Polarized p+p Collisions at sqrt(s)=200 GeV"
  Preprint: hep-ex/0404027
  - (Submitted to Physical Review Letters)
  - Compared to calculations by
    - B.Jäger *et al.*, PRD67, 054005 (2003)
    - M. Glück *et al.*, PRD63, 094005 (2001)
  - Consistent with GRSV-std (C.L. ~ 16-20%)

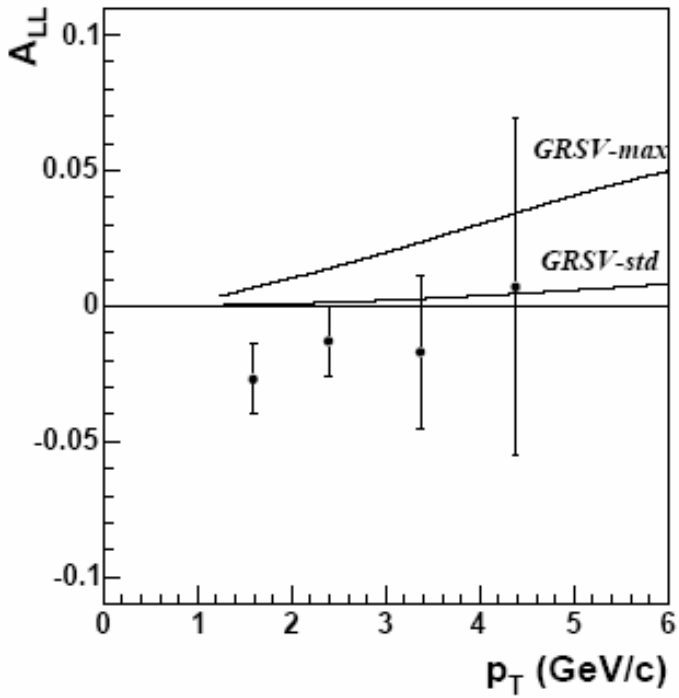
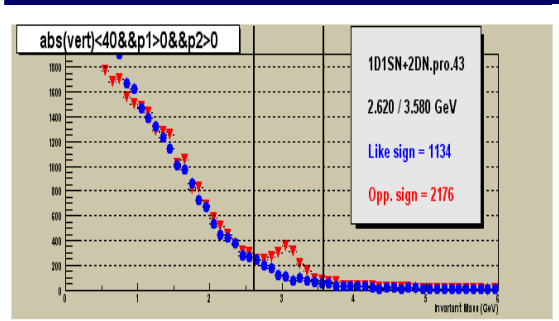
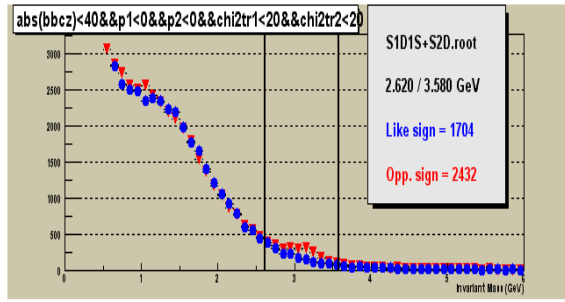


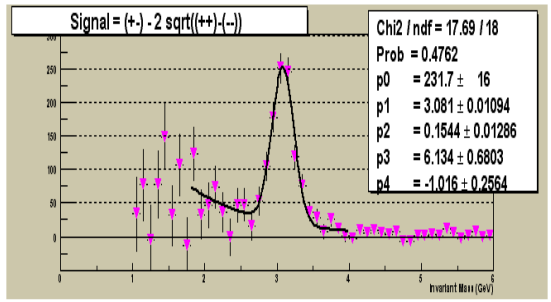
FIG. 3: The measured double spin asymmetry $A_{LL}^{\pi^0}$ versus mean p_T of π^0's in each bin. A scale uncertainty of ±65% is not included. Two theoretical calculations based on NLO pQCD are also shown for comparison with the data (see text for details).

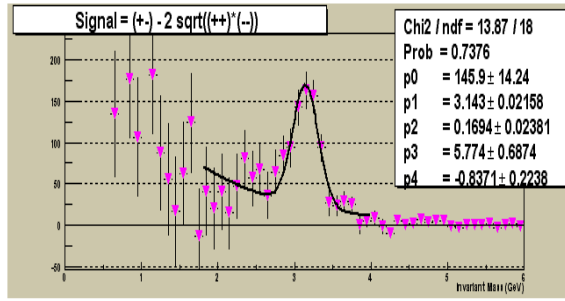
Forthcoming d+Au Results

- Range of papers in preparation:
  - Identified hadron yields
  - Jet properties
  - J/Ψ yields









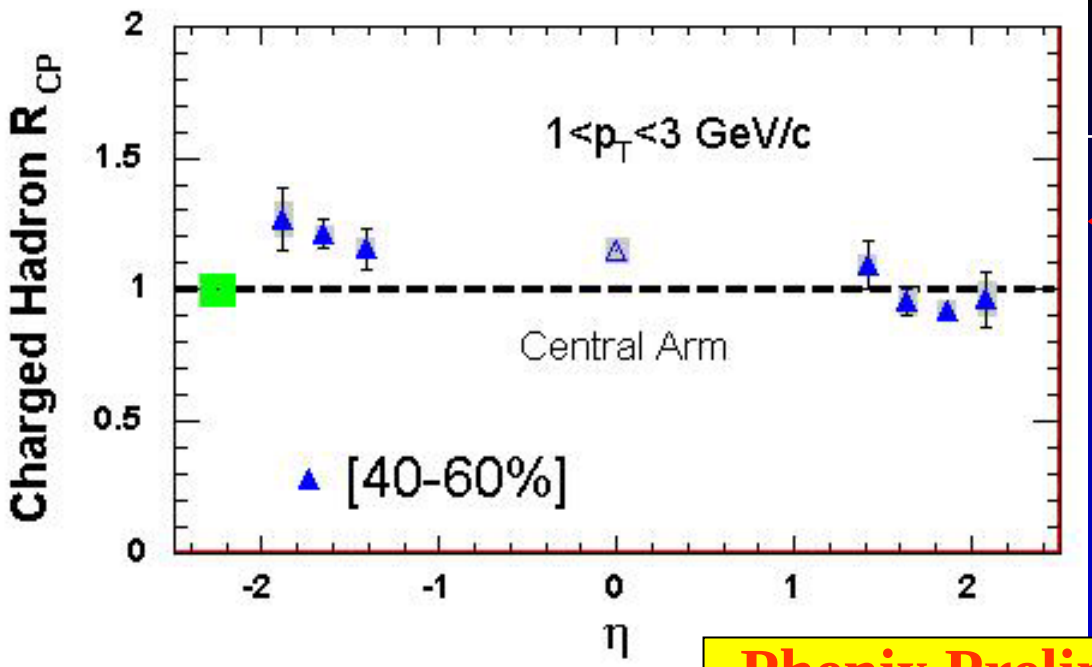
SOUTH ARM NORTH ARM

- Centrality dependence of "jet" yields
- RCP at forward and backward rapidities (next slides)

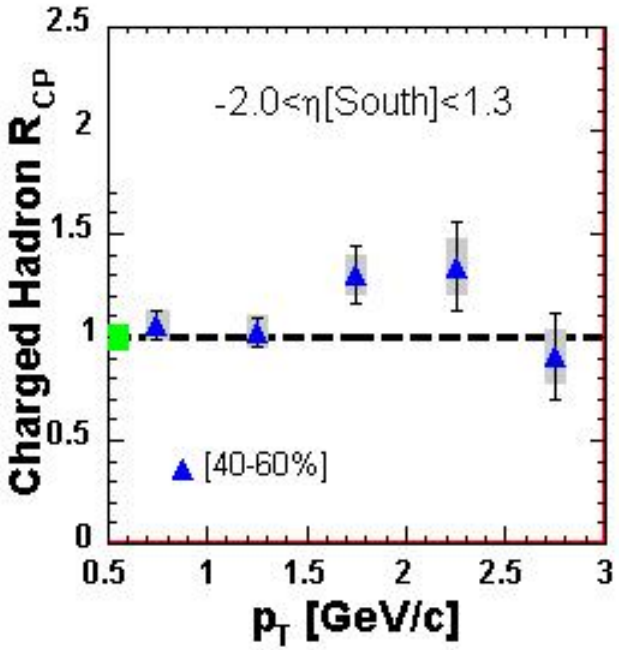
PHENIX

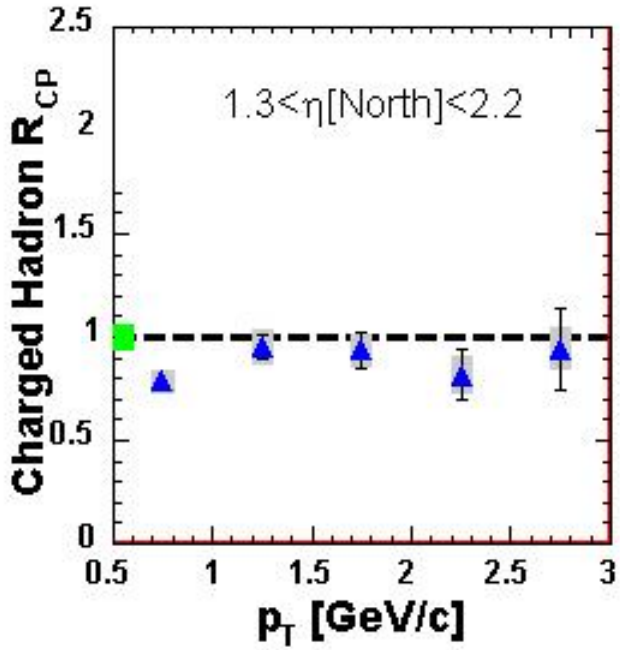
d

Au



Phenix Preliminary

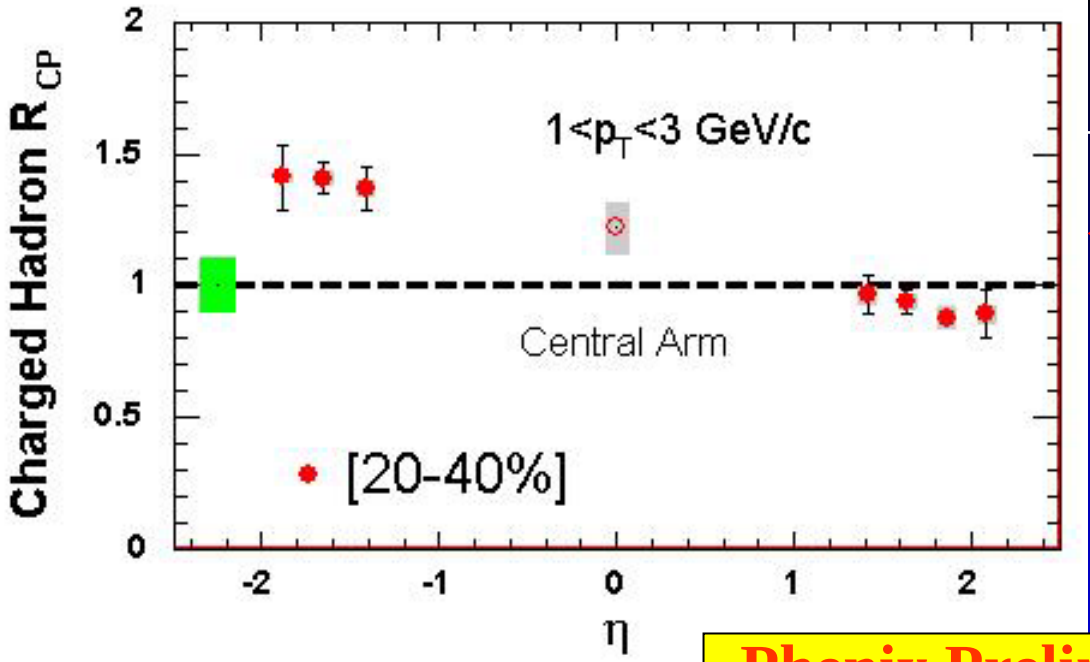




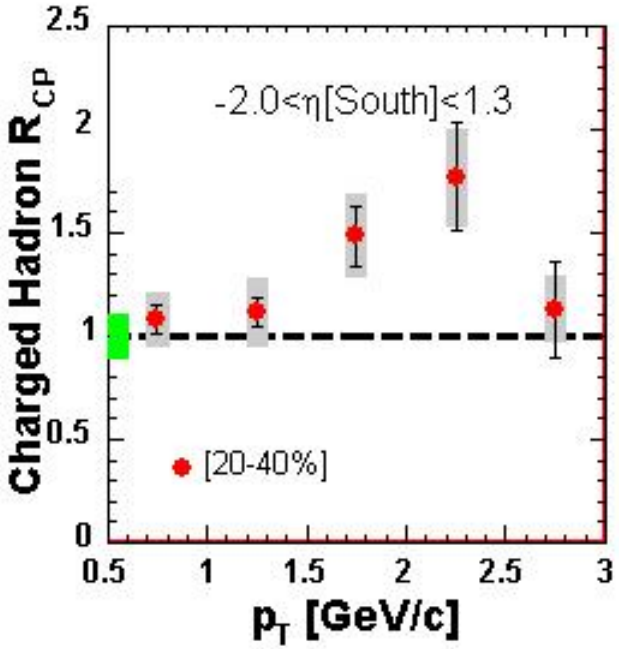
PHENIX

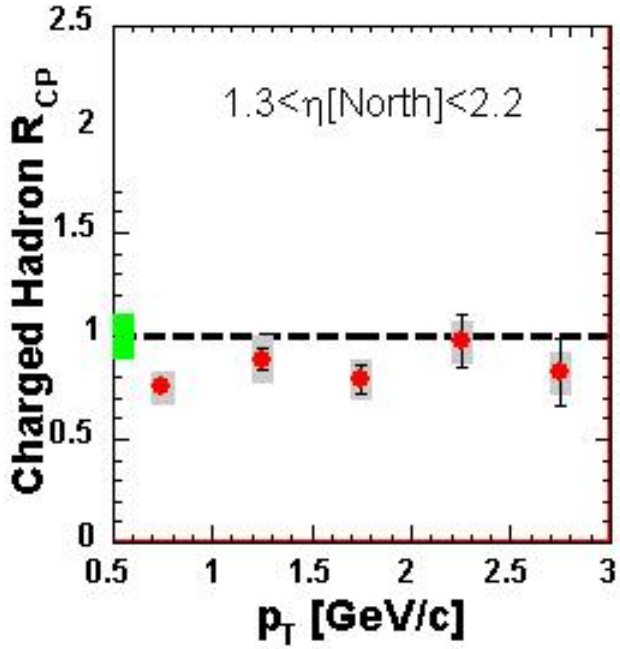
d

Au



Phenix Preliminary

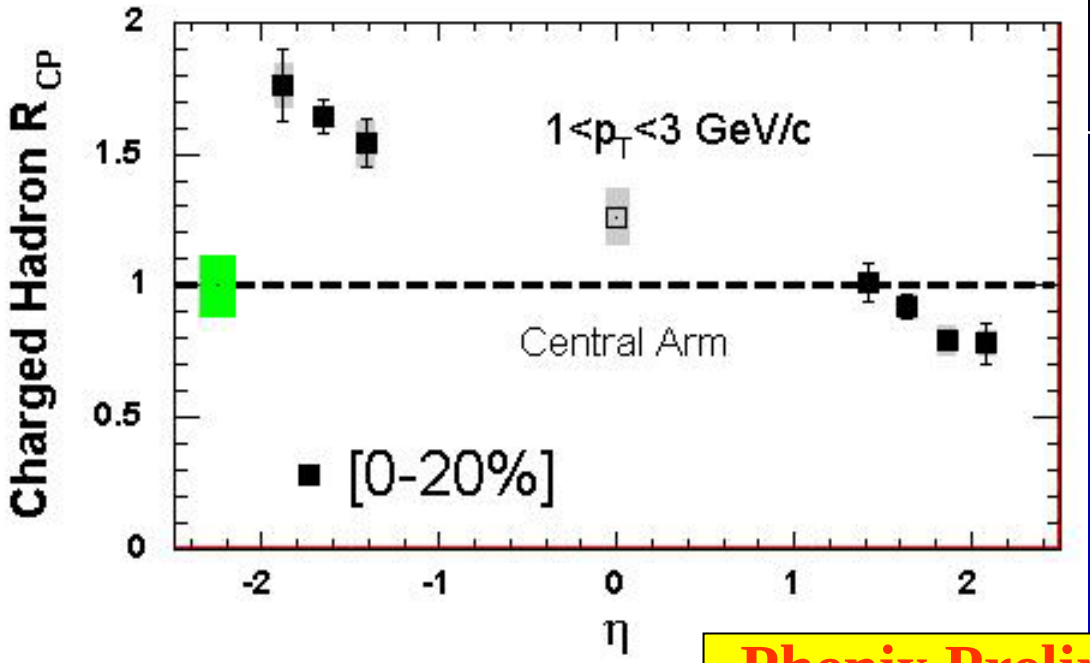




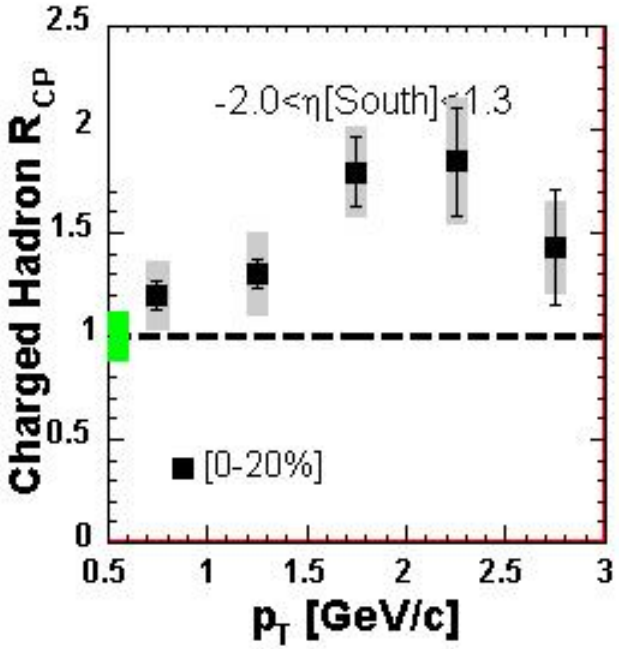
PHENIX

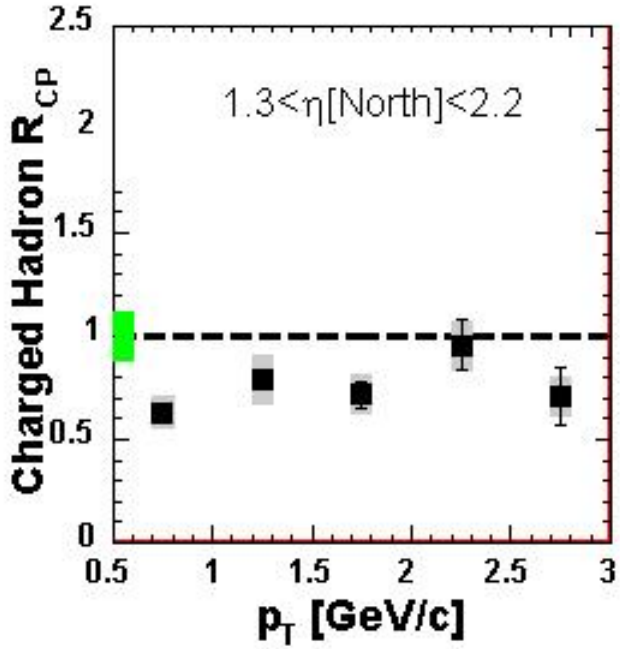
d

Au

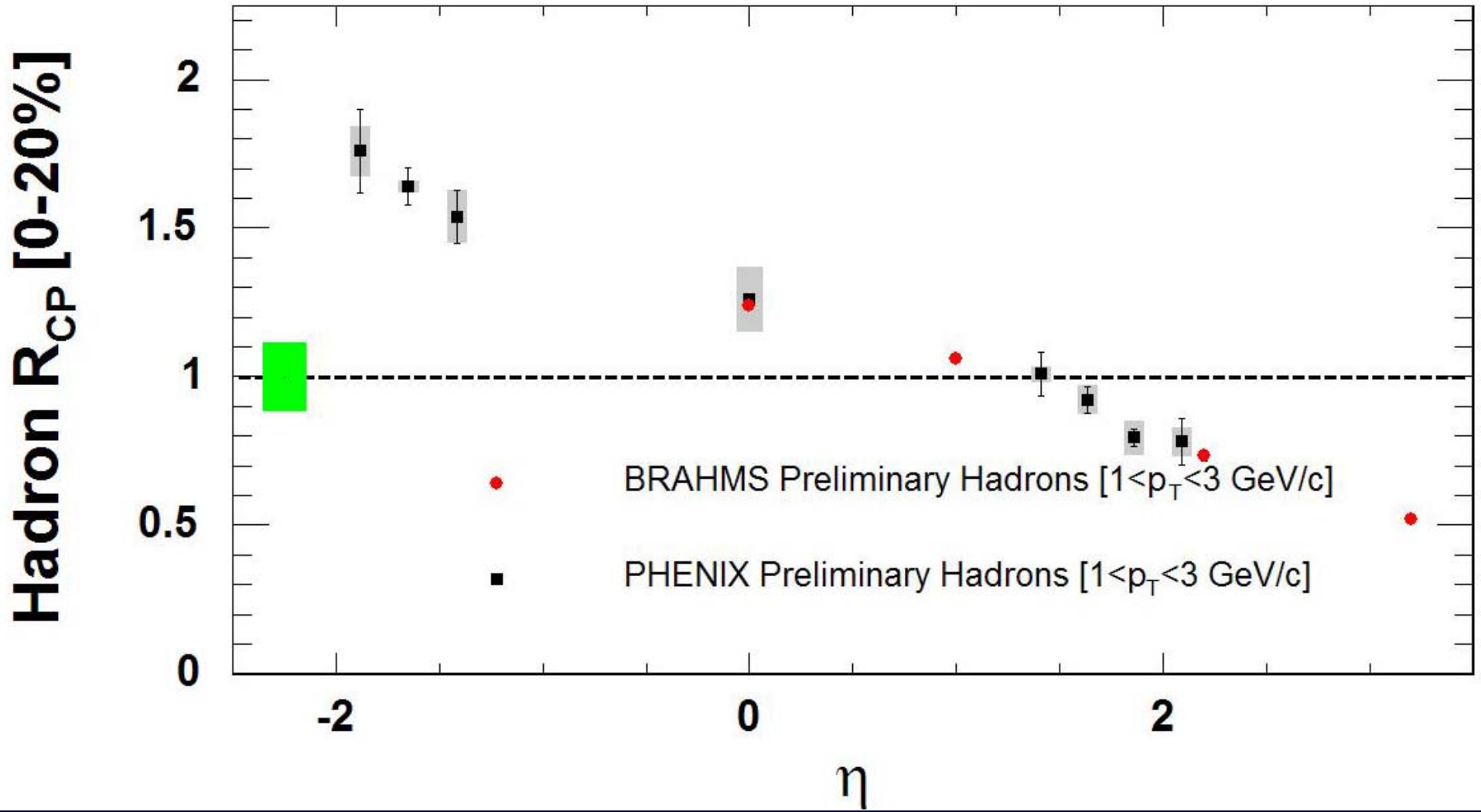


Phenix Preliminary



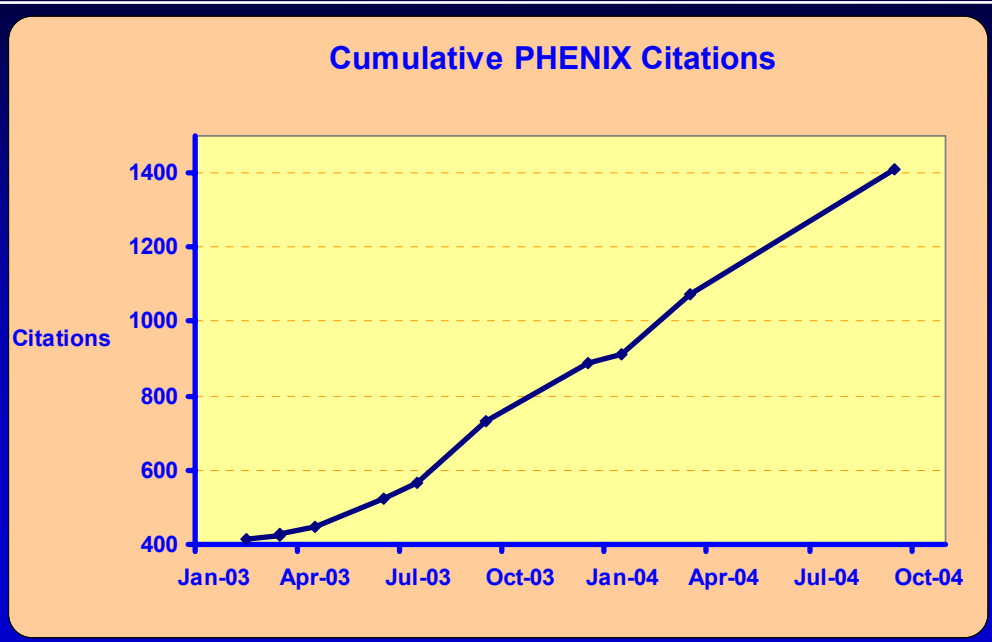


R_{CP} summary plot

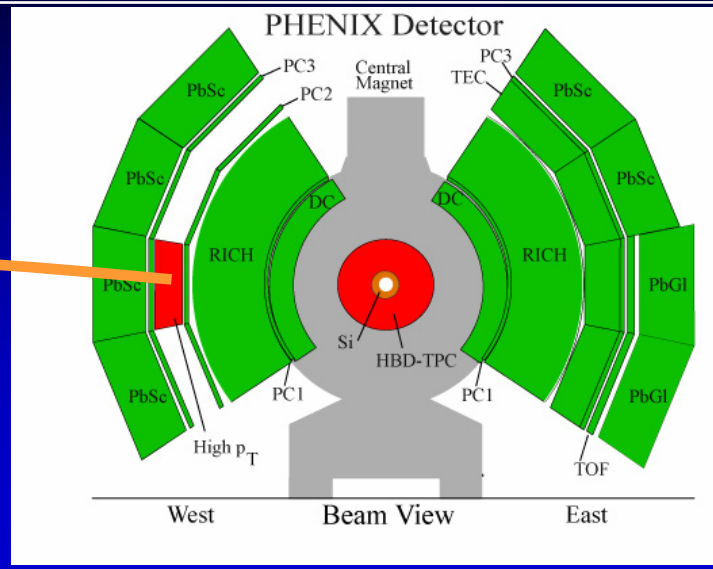


Publication Summary

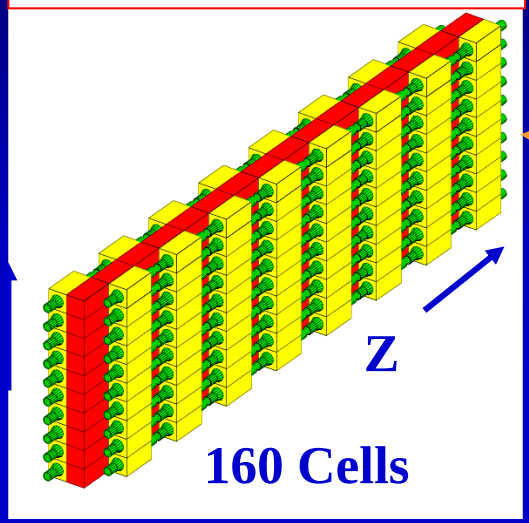
- Run-1
  - 12 publications
  - 8 are "TopCites"
    - 3 of these are "famous"
  - One "archival" summary
- Run-2
  - 12 publications to date
  - 4 are "TopCites"
    - 1 of these is "famous"
  - One "archival" summary
  - Several more nearing completion
    - Direct photons, open charm, energy survey…
- Run-3
  - 2 publications
    - d+Au suppression (a TopCite/famous)
    - First result on $A_{LL}(\pi^0)$
  - Several in progress
- Run-4: > x 10 *data-size compared to Run-2 Au+Au*

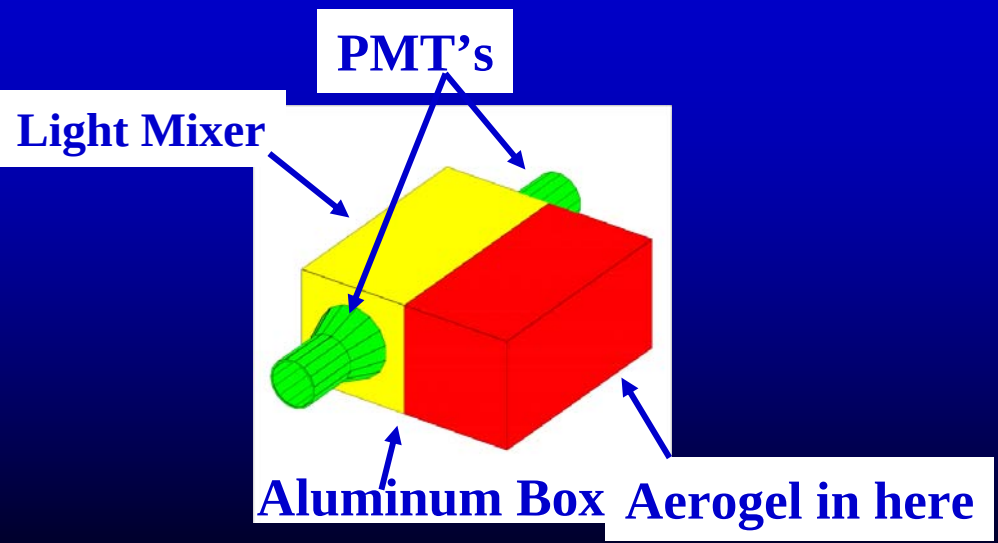


Run-4 Additions



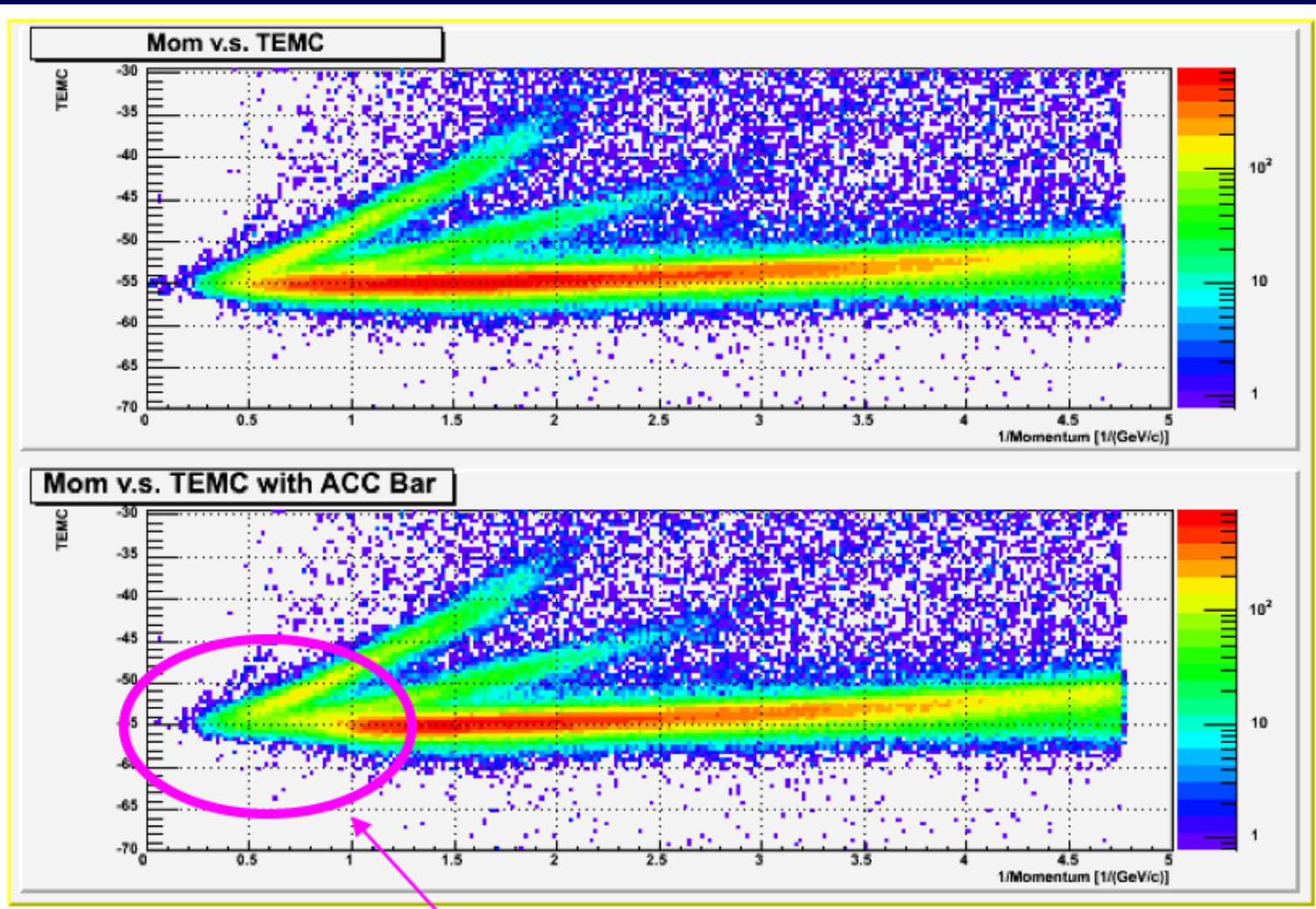
Aerogel Array





- The Aerogel detector is a threshold Cerenkov counter
- Aerogel is a very low density, SiO_2 – based solid
- Aerogel has index of refr. between gases & liquids.
- Ident. charged particles in a range inaccessible with other technologies.

Aerogel Performance



Previous Run Request

- ✓ Au+Au at 200 GeV, with goal of developing highest possible integrated luminosity
- ✓ An aggressive program of luminosity and polarization development for p+p, with the goal of the earliest practicable measurement of ΔG
- Light-ion running, to investigate dependence on system size
- ✓ A reduced energy run, again with emphasis on obtaining highest possible integrated luminosity
- ✓ High integrated luminosities achieved via minimal variations in species and energies, as per CAD guidance

Table 2: The PHENIX Beam Use Proposal for 27 cryo weeks per year

RUN	SPECIES	$\sqrt{s_{NN}}$ (GeV)	PHYSICS WEEKS	$\int \mathcal{L}dt$ (delivered)	p+p Equivalent
4	Au+Au	200	14	316 μb^{-1}	12.3 pb^{-1}
	p+p	200	(5 development)	-	
5	Si+Si	200	9	5.5 nb^{-1}	4.3 pb^{-1}
	p+p	200	5	3.0 pb^{-1}	3.0 pb^{-1}
6	Au+Au	62.4	19	117 μb^{-1}	4.3 pb^{-1}
7	p+p	200	19	158 pb^{-1}	158 pb^{-1}
8	Au+Au	200	19	2157 μb^{-1}	84 pb^{-1}
9	p+p	500	19	540 pb^{-1}	540 pb^{-1}
10	d+Au	62.4	19	3.3 nb^{-1}	1.3 pb^{-1}

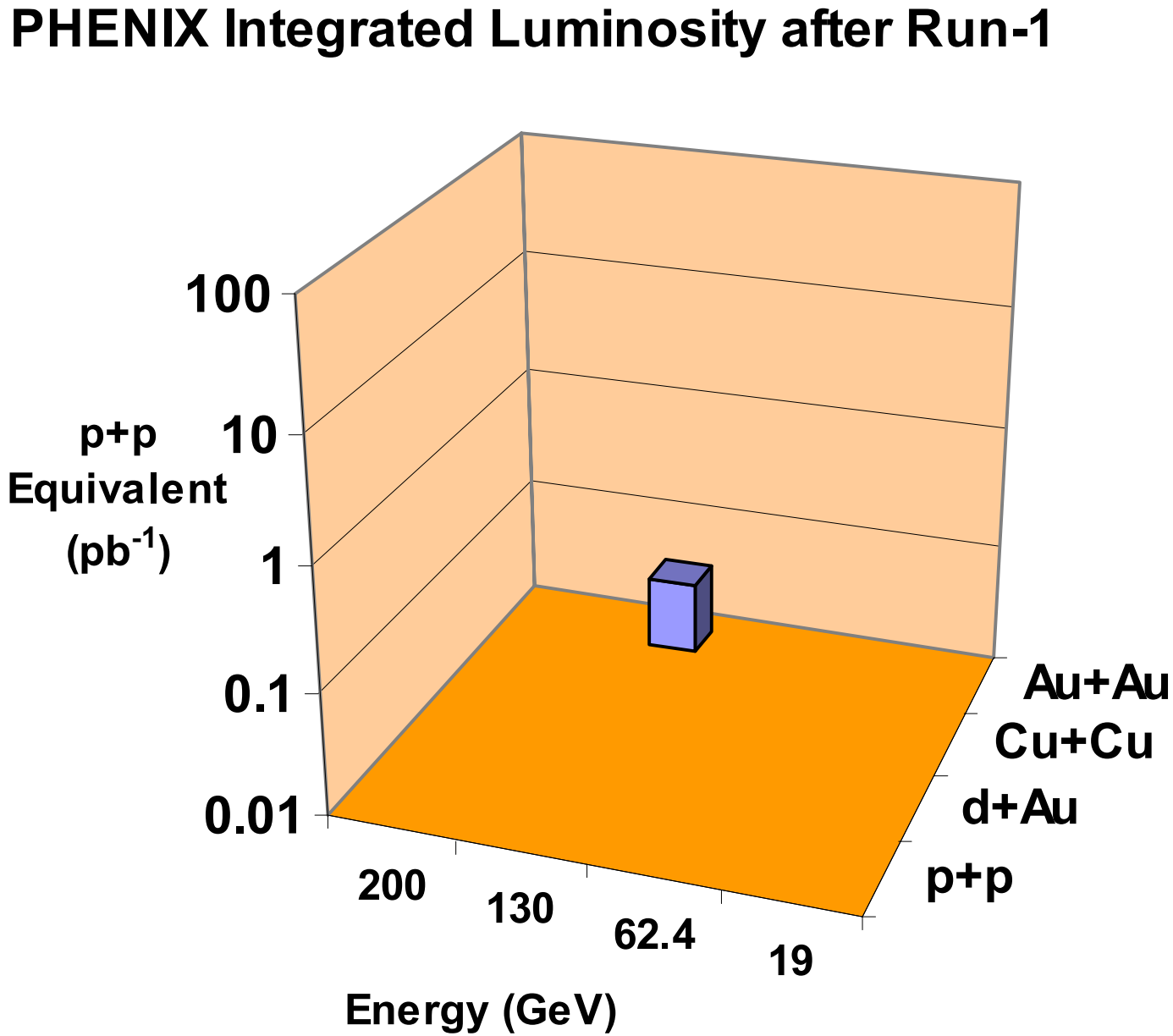
Current Run Request

- An extensive program of luminosity and polarization development for p+p,
  with the goal of the earliest practicable measurement of ΔG
- Light-ion running,
  to investigate dependence on system size
- A reduced energy run,
  again with emphasis on obtaining highest possible integrated luminosity
- High integrated luminosities achieved via minimal variations in species and energies,
  as per CAD guidance

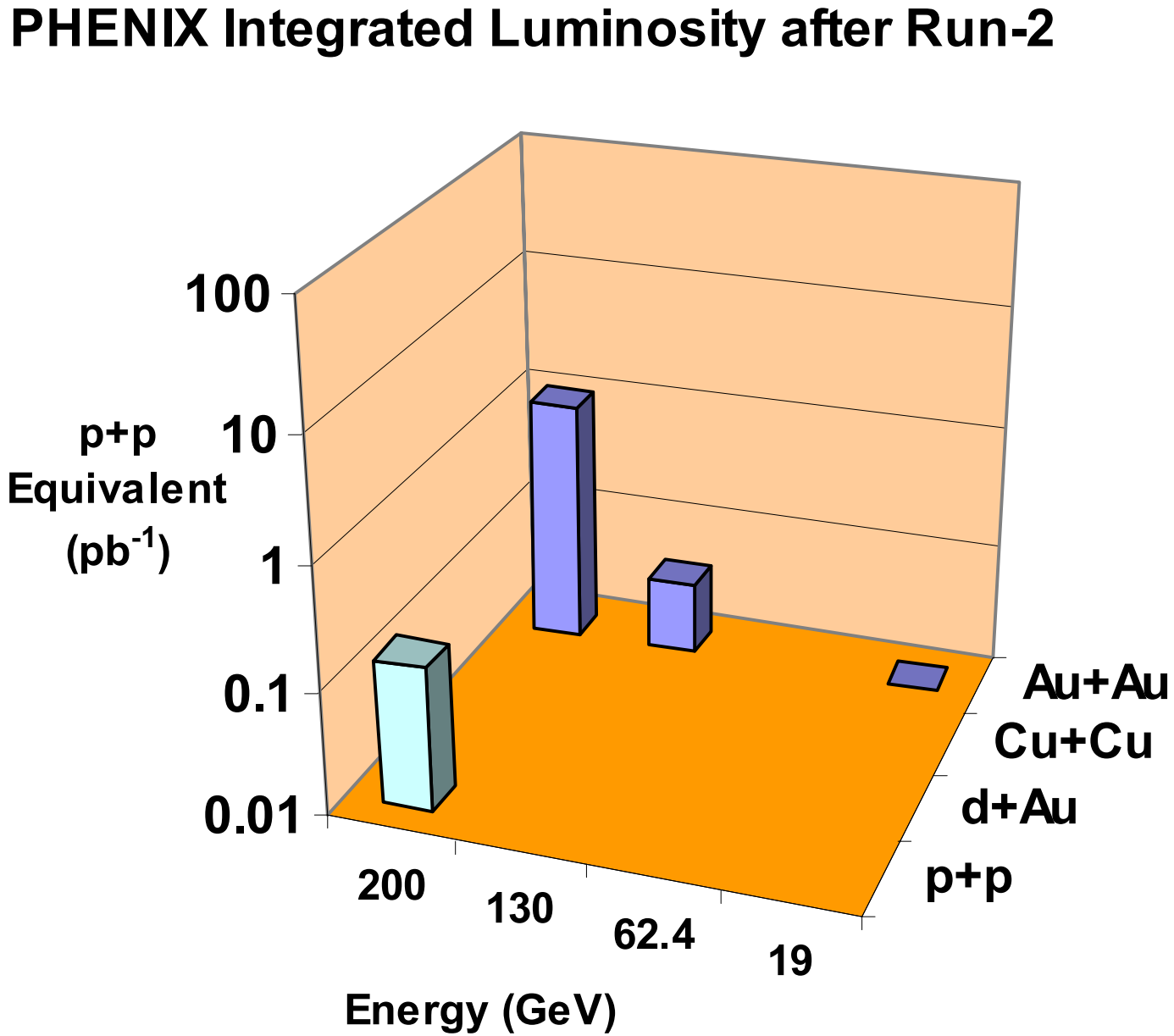
Table 2: The PHENIX Beam Use Proposal for 31 cryo weeks in Run-5, and 27 cryo weeks in latter years.

RUN	SPECIES	$\sqrt{s_{NN}}$ (GeV)	PHYSICS WEEKS	$\int \mathcal{L}dt$ (delivered)	p+p Equivalent
5	Cu+Cu	200	10	7.0 nb^{-1}	27.6 pb^{-1}
	p+p	200	11	13.1 pb^{-1}	13.1 pb^{-1}
6	Au+Au	62.4	9	111 μb^{-1}	4.3 pb^{-1}
	p+p	200	8	15.0 pb^{-1}	15.0 pb^{-1}
7	p+p	200	20	122 pb^{-1}	122 pb^{-1}
8	Au+Au	200	20	4140 μb^{-1}	161 pb^{-1}
9	p+p	500	20	359 pb^{-1}	359 pb^{-1}
10	d+Au	200	20	91.6 nb^{-1}	36 pb^{-1}

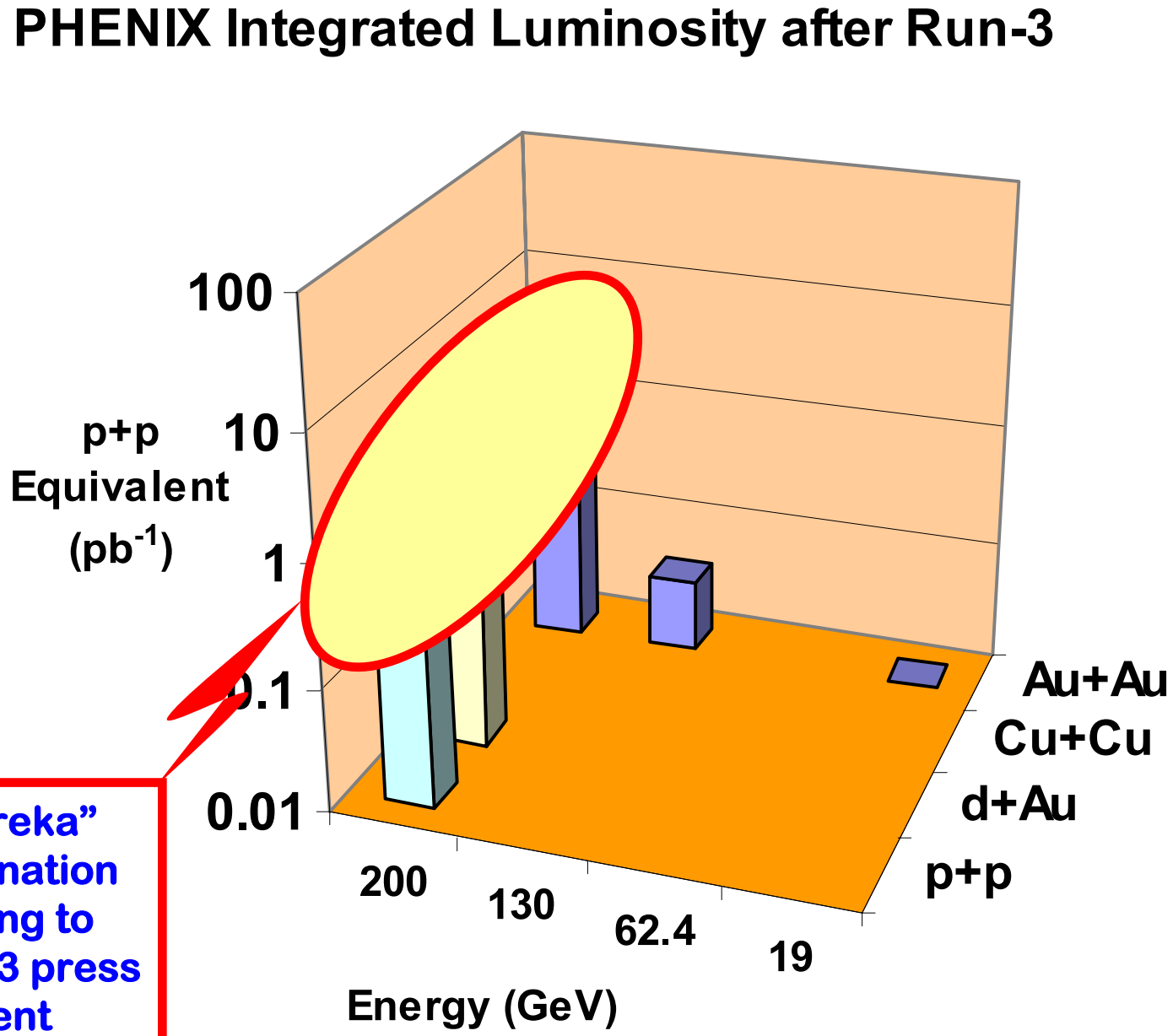
After Run-1 (Discovery)



After Run-2 (Discovery)

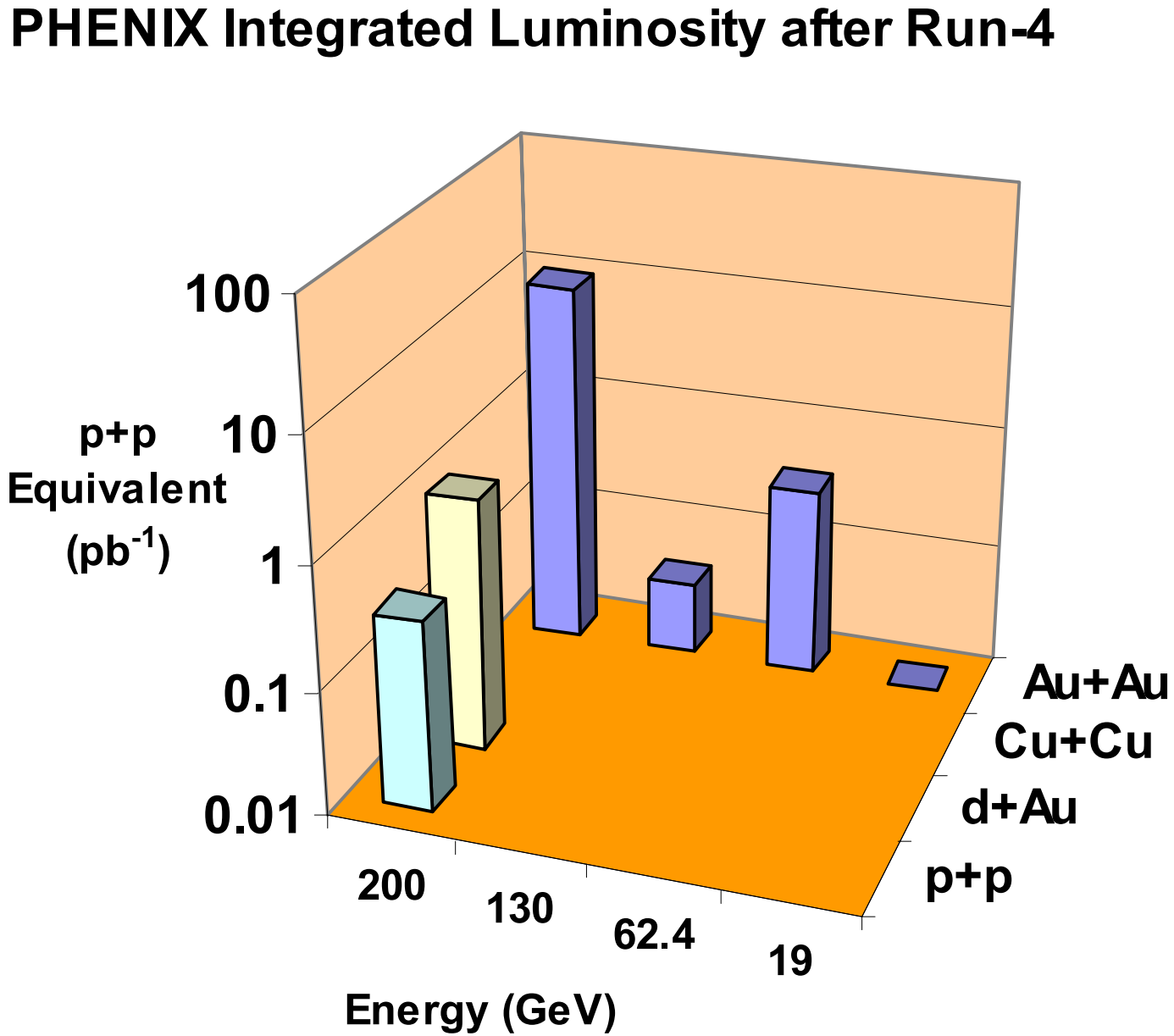


After Run-3 (Control)

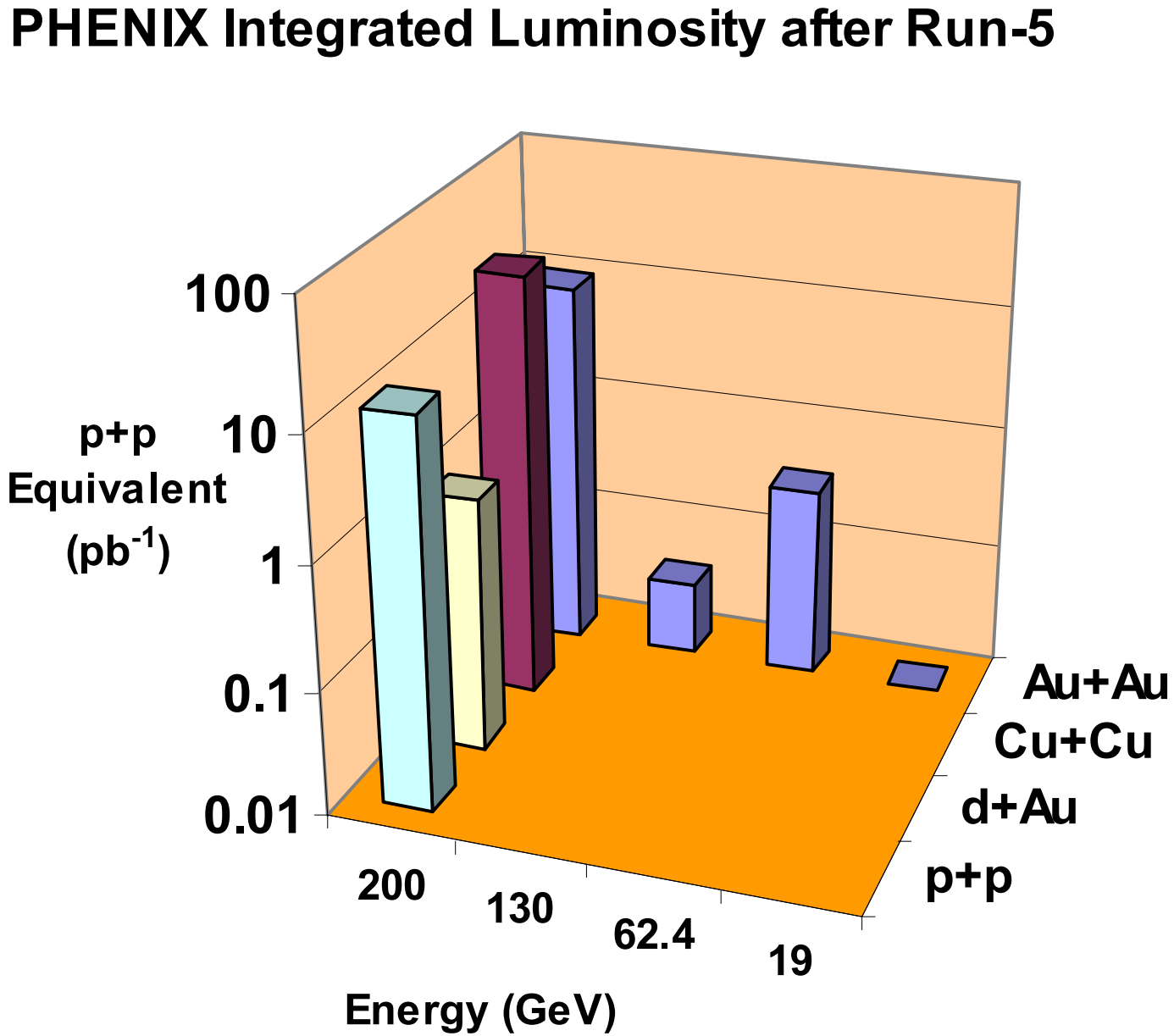


The "Eureka" combination leading to June '03 press event

After Run-4 (Frontier)

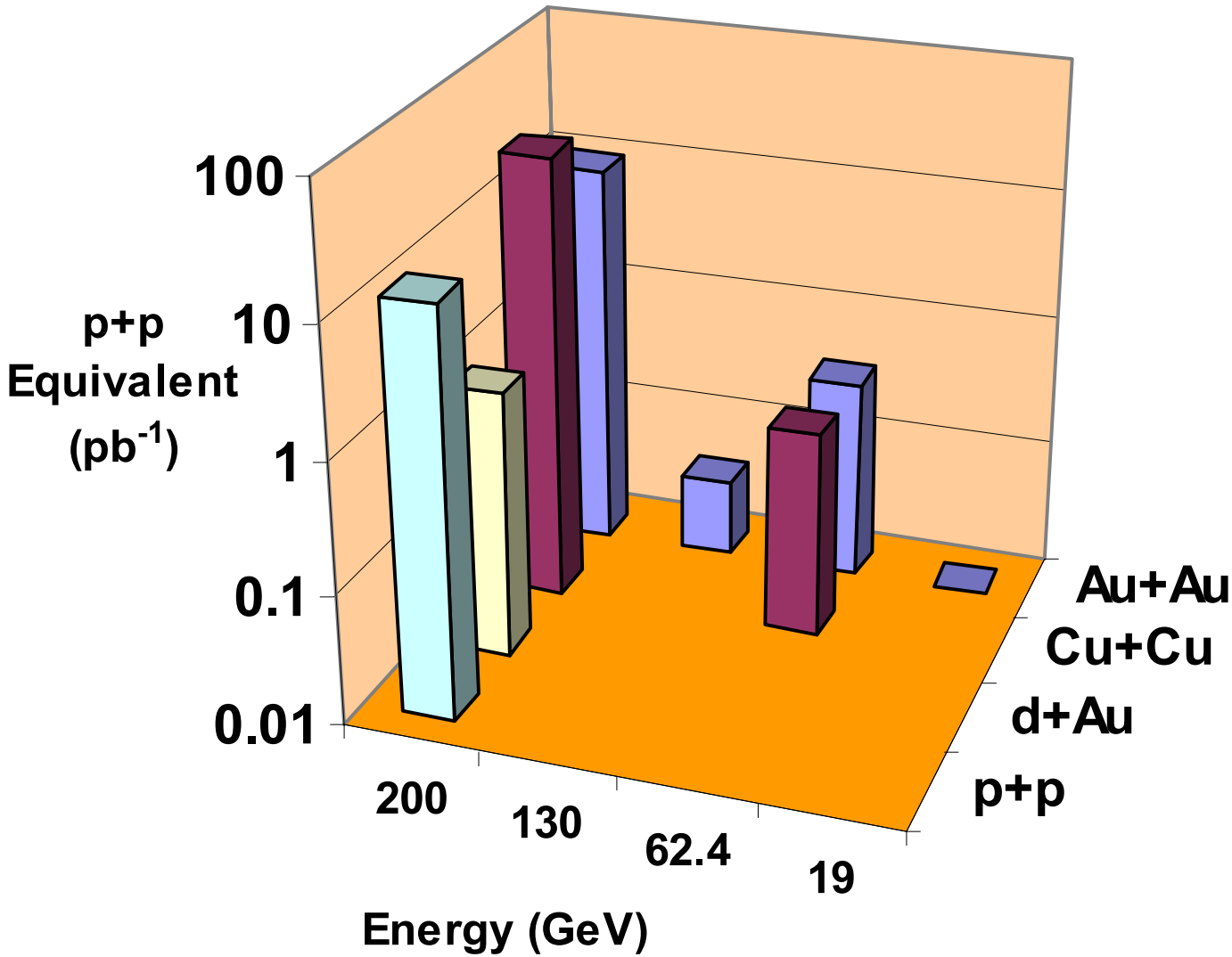


After Run-5 (Nominal)



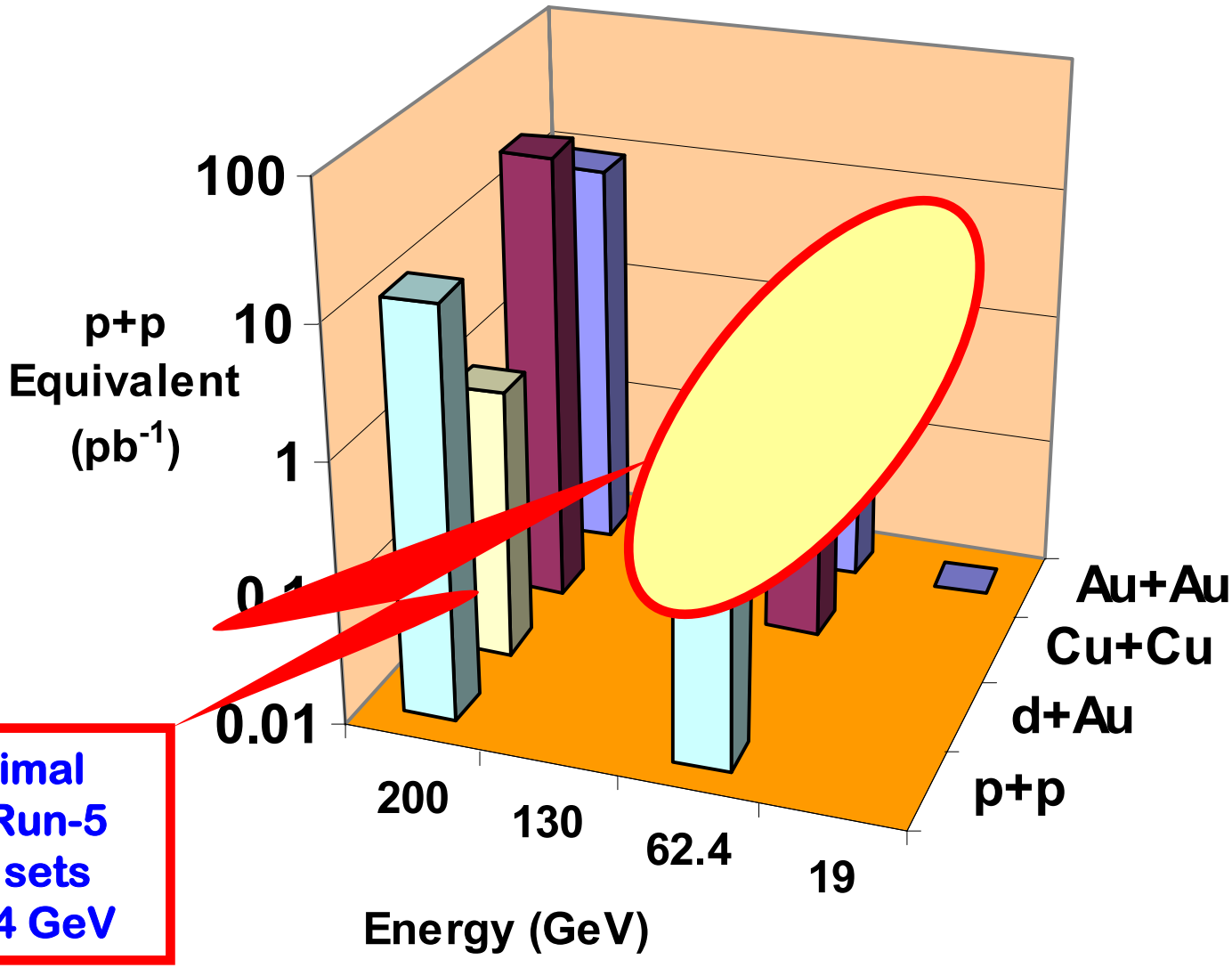
After Run-5 (Supplement 1)

PHENIX Integrated Luminosity after Run-5+Sup1.



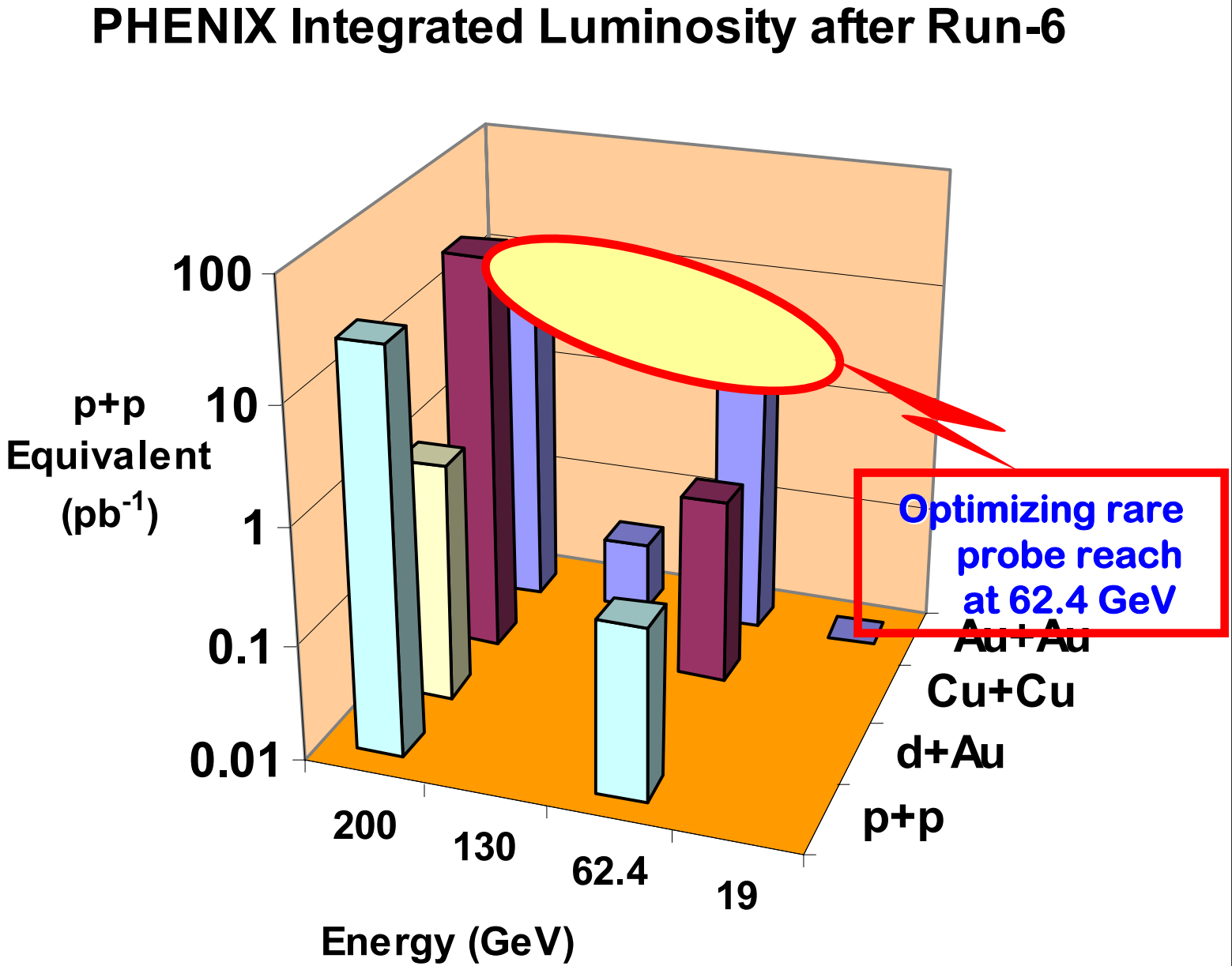
After Run-5 (Supplement 2)

PHENIX Integrated Luminosity after Run-5+Sup2.

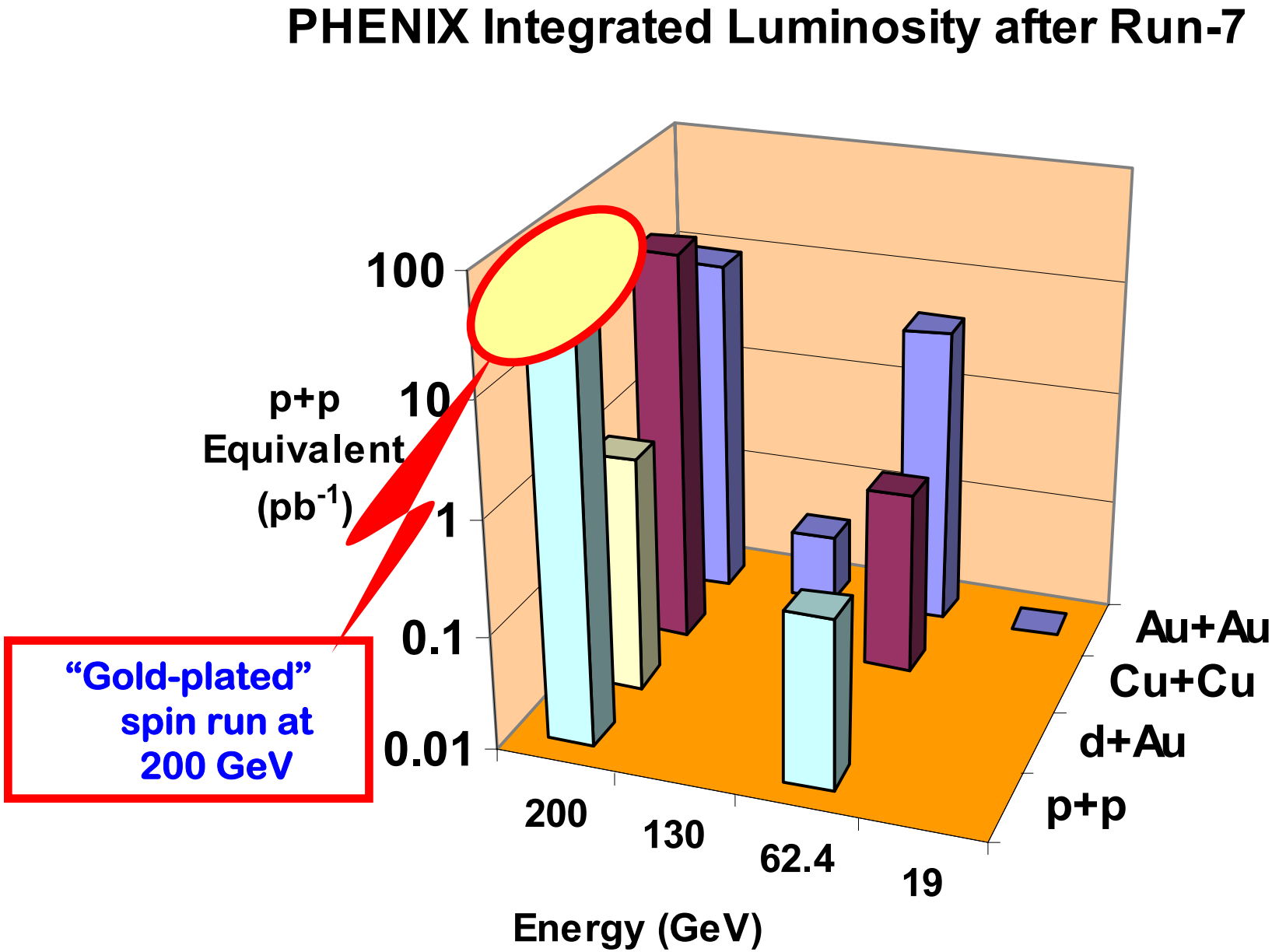


The optimal post Run-5 data sets at 62.4 GeV

After Run-6


PHENIX Integrated Luminosity after Run-6
p+p Equivalent (pb^{-1})
100
10
1
0.1
0.01
200
130
62.4
19
Energy (GeV)
Au+Au
Cu+Cu
d+Au
p+p
Optimizing rare probe reach at 62.4 GeV

After Run-7


PHENIX Integrated Luminosity after Run-7
p+p Equivalent (pb^{-1})
100
10
1
0.1
0.01
Au+Au
Cu+Cu
d+Au
p+p
200
130
62.4
19
Energy (GeV)
"Gold-plated" spin run at 200 GeV

PHENIX

- Discussion here regarding
  - Criteria for “new” running conditions at end of a given segment
  - Should be explicitly addressed by PAC
  - Resist √N arguments
  - Have a plan and a threshold in place at outset of run
  - AVOID CREATING “UNFUNDED MANDATES”, e.g., now we need a 62 GeV p+p comparison run, perhaps d+Au run- when??

The Run Plan At A Glance

- **An quantitative, integrated, planning exercise:**
  - **Quantitative:**
    - **Direct implementation of CAD guidance**
    - **Yield estimates (whenever possible) based on existing PHENIX measurements and known scaling laws**

		2004 (Run-4)	2005 (Run-5)	2006 (Run-6)	2007 (Run-7)	2008 (Run-8)	2009 (Run-9)	2010 (Run-10)
27 Weeks		14 weeks Au+Au 200 GeV 739 μb^{-1} 197 197 28.69 pb^{-1}	8 weeks Cu+Cu 200 GeV 2.1 nb^{-1} 63 63 8.29 pb^{-1}	9 weeks Au+Au 62.4 GeV 47 μb^{-1} 197 197 1.81 pb^{-1}	0 weeks Au+Au 200 GeV 0 μb^{-1} 197 197 0.00 pb^{-1}	20 weeks Au+Au 200 GeV 1739 μb^{-1} 197 197 67.47 pb^{-1}	0 weeks Au+Au 200 GeV 0 μb^{-1} 197 197 0.00 pb^{-1}	20 weeks d-Au 200 GeV 38.5 nb^{-1} 2 197 15.16 pb^{-1}
	J/Ψ	9855 J/Ψ's	6484 J/Ψ's	127 J/Ψ's	0 J/Ψ's	23180 J/Ψ's	0 J/Ψ's	14961 J/Ψ's
	p_T(max)	22.2 GeV/c	19.1 GeV/c	10.5 GeV/c	0.0 GeV/c	24.6 GeV/c	0.0 GeV/c	20.5 GeV/c
		1 weeks	9 weeks	8 weeks	20 weeks	0 weeks	20 weeks	0 weeks
		p+p 200 GeV 0.2 pb^{-1} 30%	p+p 200 GeV 4.1 pb^{-1} 45%	p+p 200 GeV 6 pb^{-1} 65%	p+p 200 GeV 51 pb^{-1} 70%	p+p 500 GeV 0 pb^{-1} 70%	p+p 500 GeV 151 pb^{-1} 70%	p+p 500 GeV 0 pb^{-1} 70%
	J/Ψ	338 J/Ψ's	6625 J/Ψ's	9760 J/Ψ's	81790 J/Ψ's	0 J/Ψ's	675435 J/Ψ's	0 J/Ψ's
	p_T(max)	12.3 GeV/c	17.5 GeV/c	18.4 GeV/c	23.7 GeV/c	0.0 GeV/c	37.6 GeV/c	0.0 GeV/c
	$A_{LL}(\pi^0)$ p_T(max)	4.0 GeV/c	6.9 GeV/c	8.6 GeV/c	11.5 GeV/c	0.0 GeV/c	18.2 GeV/c	0.0 GeV/c
		28.90 pb^{-1}	41.33 pb^{-1}	49.24 pb^{-1}	100.35 pb^{-1}	167.83 pb^{-1}	318.67 pb^{-1}	333.83 pb^{-1}
31 Weeks		19 weeks Au+Au 200 GeV 1075 μb^{-1} 197 197 41.73 pb^{-1}	10 weeks Cu+Cu 200 GeV 2.9 nb^{-1} 63 63 11.60 pb^{-1}	10 weeks Au+Au 62.4 GeV 54 μb^{-1} 197 197 2.11 pb^{-1}	5 weeks p-p 62.4 GeV 2.9 pb^{-1} 1 1 2.94 pb^{-1}	16 weeks Au+Au 200 GeV 1330 μb^{-1} 197 197 51.60 pb^{-1}	0 weeks d-Au 62.4 GeV 0 nb^{-1} 2 197 0.00 pb^{-1}	29 weeks d-Au 62.4 GeV 5.7 nb^{-1} 2 197 2.26 pb^{-1}
	J/Ψ	14335 J/Ψ's	9077 J/Ψ's	148 J/Ψ's	961 J/Ψ's	17726 J/Ψ's	0 J/Ψ's	455 J/Ψ's
	p_T(max)	23.2 GeV/c	19.9 GeV/c	10.7 GeV/c	11.1 GeV/c	23.8 GeV/c	0.0 GeV/c	10.7 GeV/c
		6 weeks	11 weeks	11 weeks	16 weeks	5 weeks	24 weeks	0 weeks
		p+p 200 GeV 2.4 pb^{-1} 40%	p+p 200 GeV 5.5 pb^{-1} 45%	p+p 200 GeV 9.8 pb^{-1} 65%	p+p 200 GeV 39 pb^{-1} 70%	p+p 500 GeV 24 pb^{-1} 70%	p+p 500 GeV 186 pb^{-1} 70%	p+p 500 GeV 0 pb^{-1} 70%
	J/Ψ	3892 J/Ψ's	8834 J/Ψ's	15617 J/Ψ's	62546 J/Ψ's	105537 J/Ψ's	834361 J/Ψ's	0 J/Ψ's
	p_T(max)	16.5 GeV/c	18.2 GeV/c	19.5 GeV/c	23.0 GeV/c	30.0 GeV/c	38.5 GeV/c	0.0 GeV/c
	$A_{LL}(\pi^0)$ p_T(max)	6.1 GeV/c	7.1 GeV/c	9.1 GeV/c	11.2 GeV/c	14.6 GeV/c	18.7 GeV/c	0.0 GeV/c
		44.16 pb^{-1}	61.26 pb^{-1}	73.15 pb^{-1}	115.19 pb^{-1}	190.39 pb^{-1}	376.69 pb^{-1}	378.94 pb^{-1}

- **Integrated: Sequential set of measurements designed to deliver comparable sensitivities in ~ all channels**
- **Planning: Based on *current, improved* knowledge of machine, detector, physics and future developments**

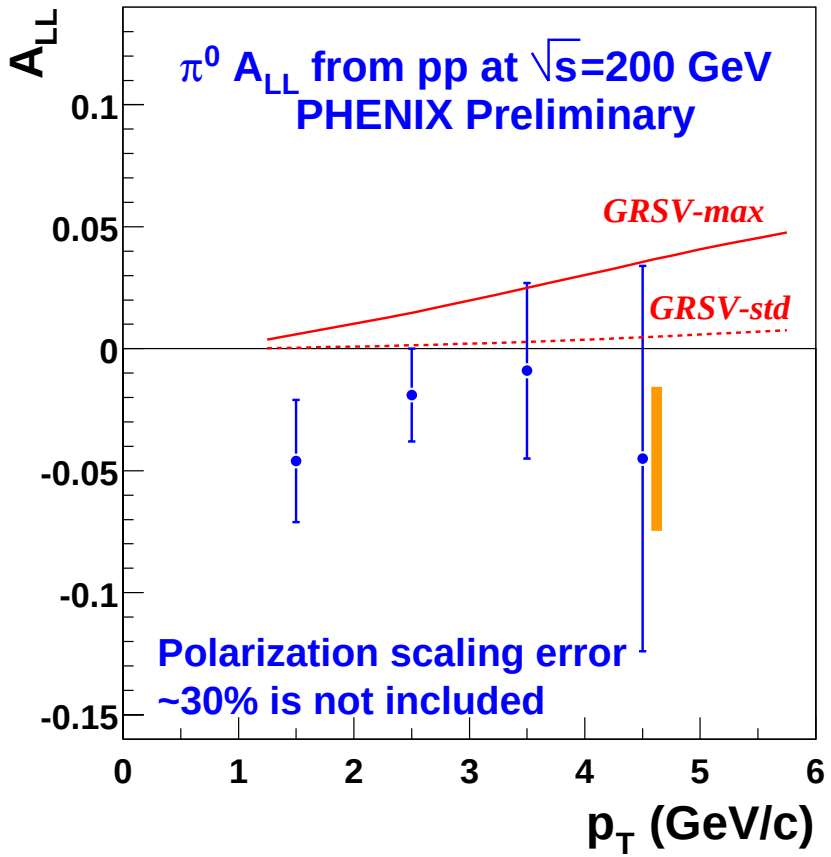
Run-5

- 31 weeks
  - Cu+Cu 200 GeV
    - 10 physics weeks
    - Many rare channels
  - p+p 200 GeV
    - 11 physics weeks
    - $A_{LL}(\pi^0)$
- 27 weeks
  - Cu+Cu 200 GeV
    - 8 physics weeks
    - Many rare channels
  - p+p 200 GeV
    - 9 physics weeks
    - $A_{LL}(\pi^0)$

		2005 (Run-5)					
27 Weeks		8 weeks					
		Cu+Cu	200 GeV		2.1 nb^{-1}		
		63	63		8.29 pb^{-1}		
	J/Ψ				6484 J/Ψ's		
	p_T(max)				19.1 GeV/c		
		9 weeks					
		p+p	200 GeV		4.1 pb^{-1}	45%	
	J/Ψ				6625 J/Ψ's		
	p_T(max)				17.5 GeV/c		
	$A_{LL}(\pi^0)$ p_T(max)				6.9 GeV/c		
					41.33 pb^{-1}		
31 Weeks		10 weeks					
		Cu+Cu	200 GeV		2.9 nb^{-1}		
		63	63		11.60 pb^{-1}		
	J/Ψ				9077 J/Ψ's		
	p_T(max)				19.9 GeV/c		
		11 weeks					
		p+p	200 GeV		5.5 pb^{-1}	45%	
	J/Ψ				8834 J/Ψ's		
	p_T(max)				18.2 GeV/c		
	$A_{LL}(\pi^0)$ p_T(max)				7.1 GeV/c		
					61.28 pb^{-1}		

Spin Prospects in Run-5

- Run-3 result based on
  - <P> = 27%
  - 0.35 pb^{-1} recorded
- For future projections:
- Run-5 (31 weeks)
  - <P> = 44%
  - 5.5 pb^{-1} recorded
  - Factor ~10 improvement in statistical error
- Run-5 (27 weeks scenario)
  - <P> = 45%
  - 4.1 pb^{-1} recorded
  - Factor ~8 improvement in statistical error



Run-6

- 27 weeks
  - Au+Au 62.4 GeV
    - 9 physics weeks
    - *Some* rare channels
  - p+p 200 GeV
    - 8 physics weeks
    - Use cold snake
- 31 weeks
  - Au+Au 62.4 GeV
    - 10 physics weeks
    - Some rare channels
  - p+p 200 GeV
    - 11 physics weeks
    - Use cold snake

		2006 (Run-6)						
27 Weeks		9 weeks						
		Au+Au	62.4 GeV		47	μb^{-1}		
		197	197		1.81	pb^{-1}		
	J/Ψ				127	J/Ψ's		
	p_T(max)				10.5	GeV/c		
		8 weeks						
		p+p	200 GeV		6	pb^{-1}	65%	
	J/Ψ				9760	J/Ψ's		
	p_T(max)				18.4	GeV/c		
	$A_{LL}(\pi^0)$ p_T(max)				8.6	GeV/c		
					49.24	pb^{-1}		
31 Weeks		10 weeks						
		Au+Au	62.4 GeV		54	μb^{-1}		
		197	197		2.11	pb^{-1}		
	J/Ψ				148	J/Ψ's		
	p_T(max)				10.7	GeV/c		
		11 weeks						
		p+p	200 GeV		9.8	pb^{-1}	65%	
	J/Ψ				15617	J/Ψ's		
	p_T(max)				19.5	GeV/c		
	$A_{LL}(\pi^0)$ p_T(max)				9.1	GeV/c		
					73.15	pb^{-1}		

Run-7

- 27 weeks
  - p+p 200 GeV
    - 20 physics weeks
    - Spin *production* run
    - "Ultimate" comparison set
- 31 weeks
  - p+p 62.4 GeV
    - 5 physics weeks
    - *Some* rare channels
    - ISR *extension*
    - (No species change)
  - p+p 200 GeV
    - 16 physics weeks
    - Spin *production* run
    - "Ultimate" comparison set

		2007 (Run-7)					
27 Weeks		0	weeks				
		Au+Au		200	GeV	0	μb^{-1}
		197		197		0.00	pb^{-1}
	J/Ψ					0	J/Ψ's
	p_T(max)					0.0	GeV/c
		20	weeks				
		p+p		200	GeV	51	pb^{-1} 70%
	J/Ψ					81790	J/Ψ's
	p_T(max)					23.7	GeV/c
	$A_{LL}(\pi^0)$ p_T(max)					11.5	GeV/c
						100.35	pb^{-1}
31 Weeks		5	weeks				
		p-p		62.4	GeV	2.9	pb^{-1}
		1		1		2.94	pb^{-1}
	J/Ψ					961	J/Ψ's
	p_T(max)					11.1	GeV/c
		16	weeks				
		p+p		200	GeV	39	pb^{-1} 70%
	J/Ψ					62546	J/Ψ's
	p_T(max)					23.0	GeV/c
	$A_{LL}(\pi^0)$ p_T(max)					11.2	GeV/c
						146.19	pb^{-1}

Run-8

- 27 weeks
  - Au+Au 200 GeV
    - 20 physics weeks
    - "Penultimate" Au+Au run
    - First run with upgrades
- 31 weeks
  - Au+Au 200 GeV
    - 16 physics weeks
    - "Ultimate" Au+Au run
    - First run with upgrades
  - p+p 500 GeV
    - 5 physics weeks
    - Important acceleration of schedule for 500 GeV running

		2008 (Run-8)					
27 Weeks		20	weeks				
		Au+Au	200	GeV	1739	μb^{-1}	
		197	197		67.47	pb^{-1}	
	J/Ψ				23180	J/Ψ's	
	p_T(max)				24.6	GeV/c	
		0	weeks				
		p+p	500	GeV	0	pb^{-1}	70%
	J/Ψ				0	J/Ψ's	
	p_T(max)				0.0	GeV/c	
	$A_{LL}(\pi^0)$ p_T(max)				0.0	GeV/c	
					167.83	pb^{-1}	
31 Weeks		16	weeks				
		Au+Au	200	GeV	1330	μb^{-1}	
		197	197		51.60	pb^{-1}	
	J/Ψ				17726	J/Ψ's	
	p_T(max)				23.8	GeV/c	
		5	weeks				
		p+p	500	GeV	24	pb^{-1}	70%
	J/Ψ				105537	J/Ψ's	
	p_T(max)				30.0	GeV/c	
	$A_{LL}(\pi^0)$ p_T(max)				14.6	GeV/c	
					190.35	pb^{-1}	

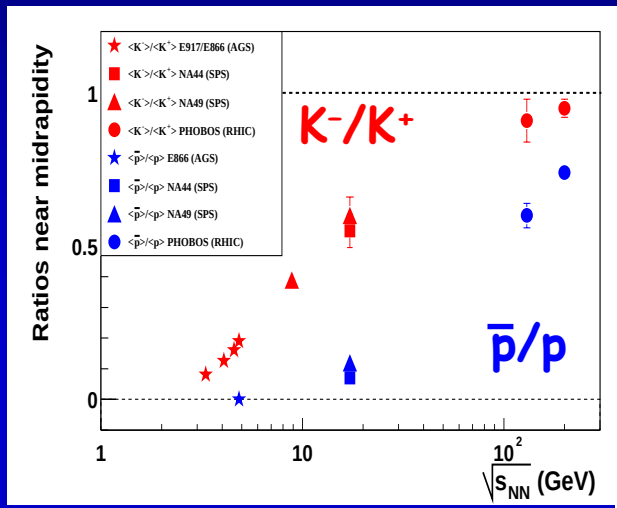
PHENIX

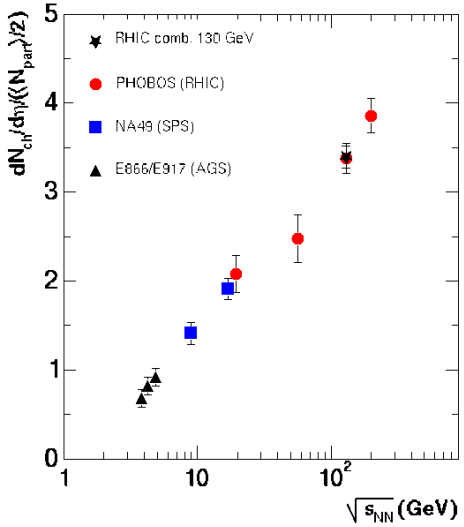
Summary

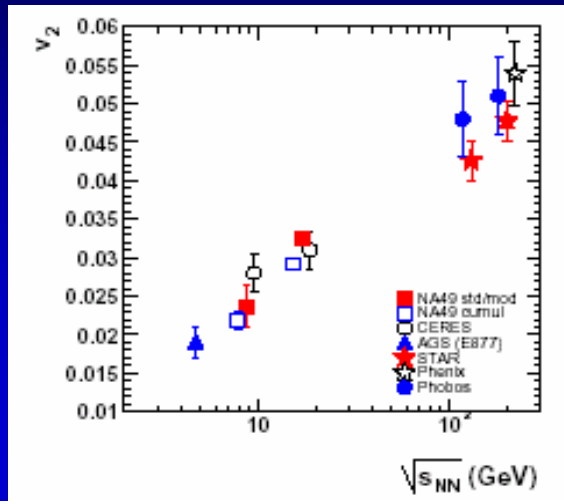
- PHENIX successes in Runs 1-4 have paralleled those of the accelerator
- Ongoing, productive enterprise engaged in timely publication of an extraordinarily broad spectrum of results (Au+Au, p+p, d+Au)
- Proposed program will extend
  - Investigation of rare processes to address fundamental questions in heavy ion physics
  - Demonstrated spin physics capabilities to higher p_T and to new channels
- Proposed program depends critically on timely development of luminosity and polarization through extended periods of beam development and steady running
- Immense benefit from incremental cost of additional weeks of running time

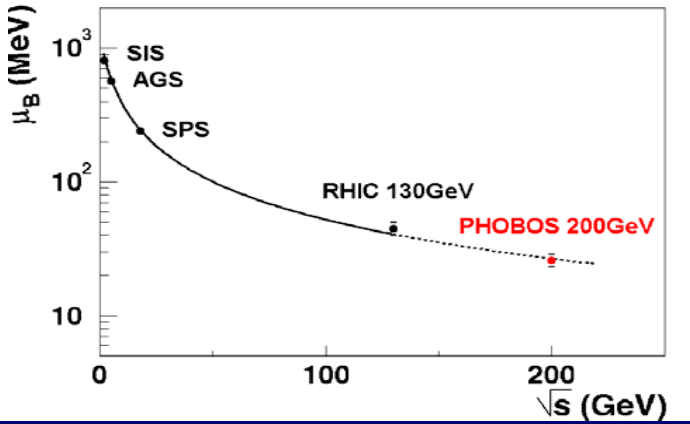
On Energy Scans

- Nearly all phenomena measured thus far exhibit smooth variation with energy:









- Those that don't(?) (e.g., kaon slopes) already present in pp data (next slide)
- Absent compelling arguments, and given
  - Natural smearing from Fermi momentum
  - Scarce beam hours

➡ Give higher priority to investigating with highest possible sensitivity the signals that are new at RHIC

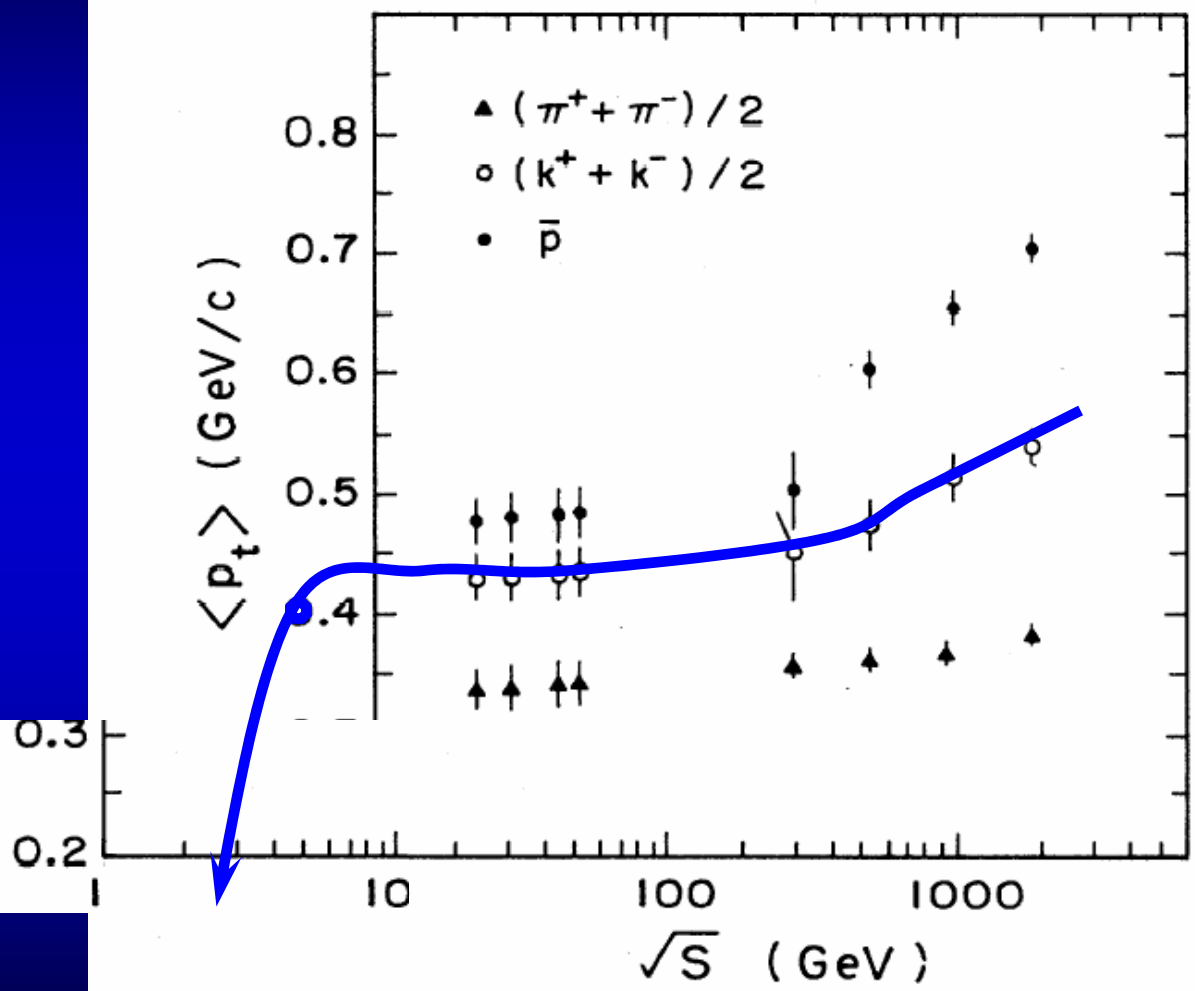


FIG. 13. Plot of $\langle p_t \rangle$ as a function of $\sqrt{s}$; the data for $\sqrt{s} < 100$ GeV are from Ref. [18].