

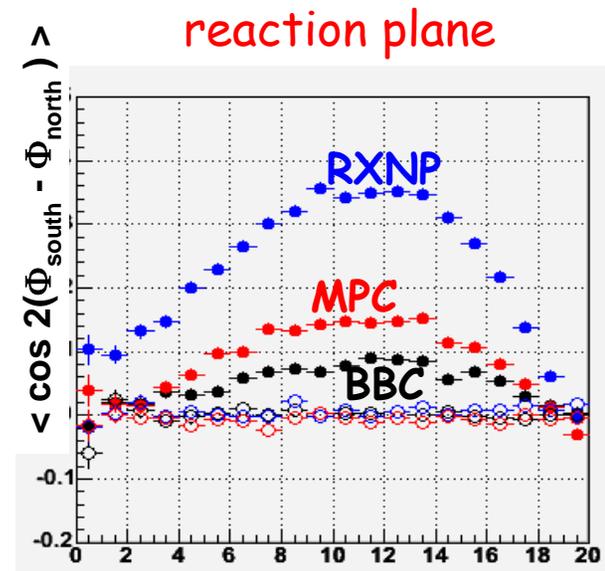
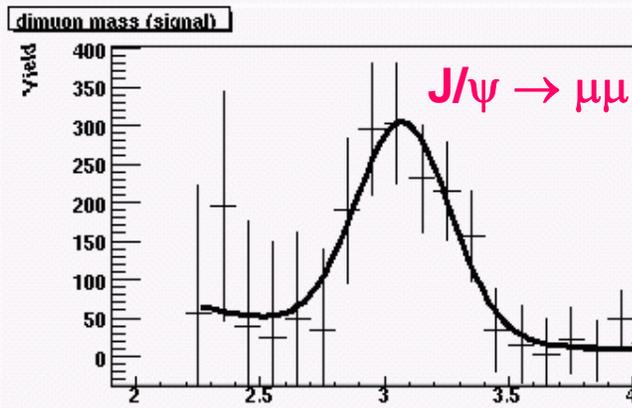
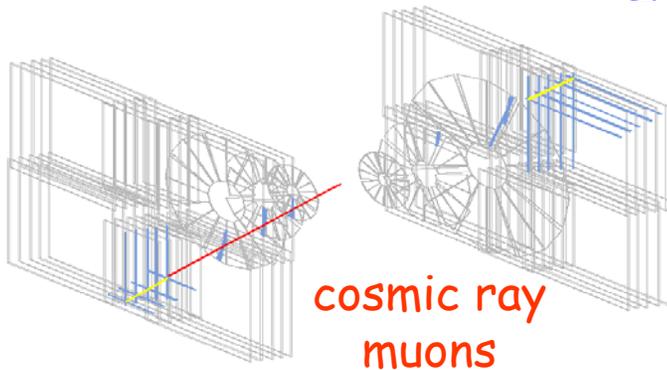
PHENIX Run7 Update

Mike Leitch, LANL

PHENIX Run Coordinator

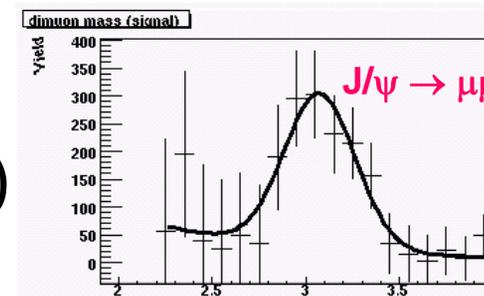
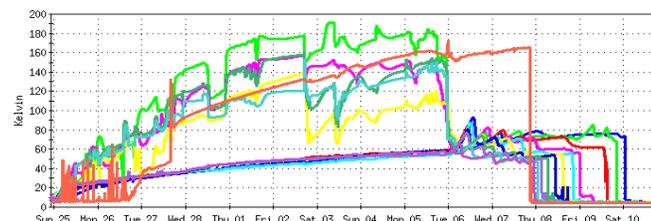
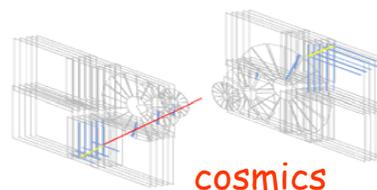
RHIC/AGS Users Meeting

21 June, 2007



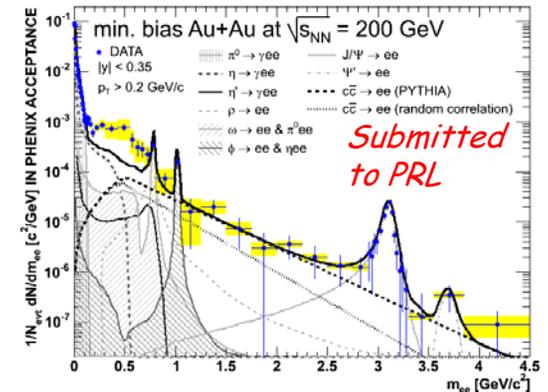
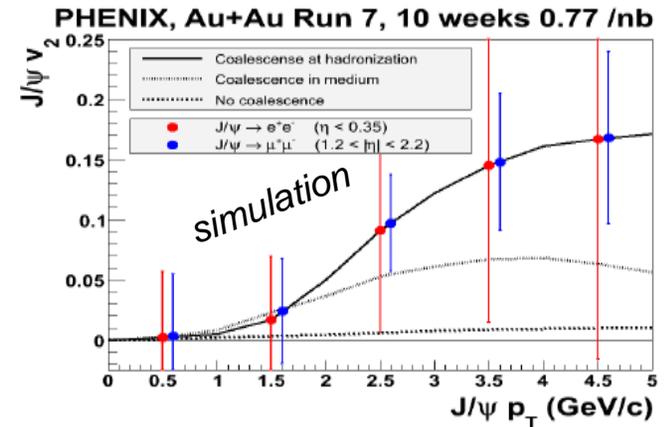
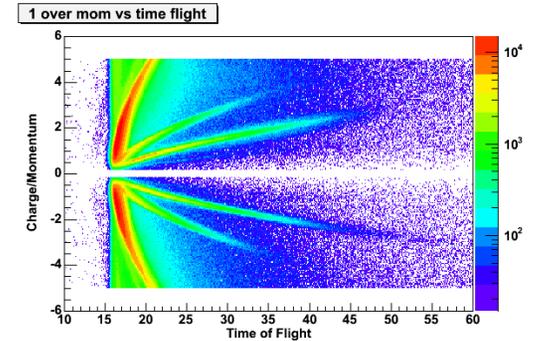
Run7 Chronology

- Originally hoped to start with Nov 1st cool-down and PHENIX planned for:
 - AuAu - 15 wks (1.1 nb⁻¹), pp - 10 wks (32 pb⁻¹)
- Delayed by continuing resolution & meager FY06 level to match
- But PHENIX started anyhow:
 - Cosmic rays starting Jan 9th
 - "Run7 is on" Feb 1st
 - Start of cool-down Feb 8th
 - Cryo problems Feb 24th
 - Rings cold & with beam Mar 13th
 - Start of Physics Mar 27th
- End of Run7 Jun 26th
- 13 wks of physics (Mar 27th - Jun 26th)

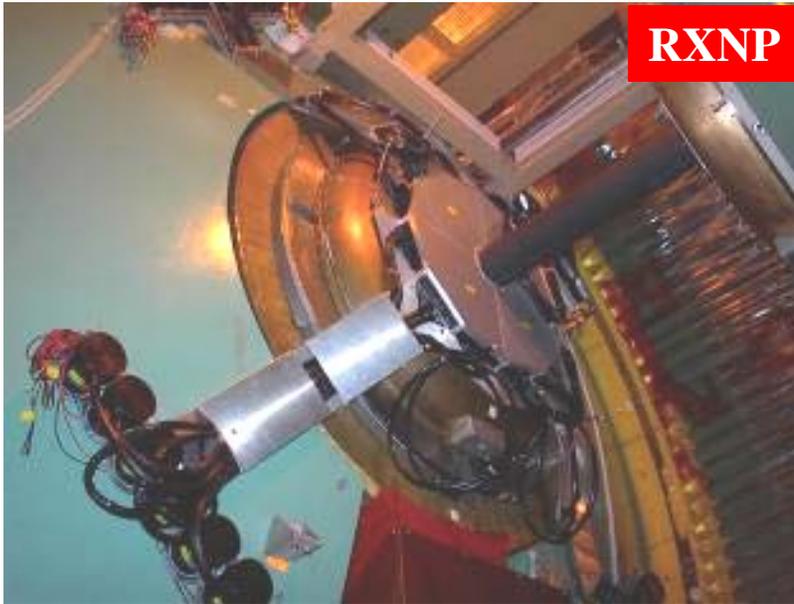


PHENIX Physics Goals for Run7

- Increase statistical & systematic precision of rare signals in AuAu, e.g. J/ψ , jet correlations, etc
- Increase reach in p_T , especially with PID from new TOF-West detector ($p_T > 8 \text{ GeV}/c$)
 - Identified particle spectra
 - Identified leading particles in jets
- Factor of two or more improvement in Reaction Plane resolution - valuable to many signals
 - v_2 for J/ψ , γ - new
 - electrons, hadrons - extended
- Low-mass lepton pairs with the HBD



Four New Detector Subsystems for Run7



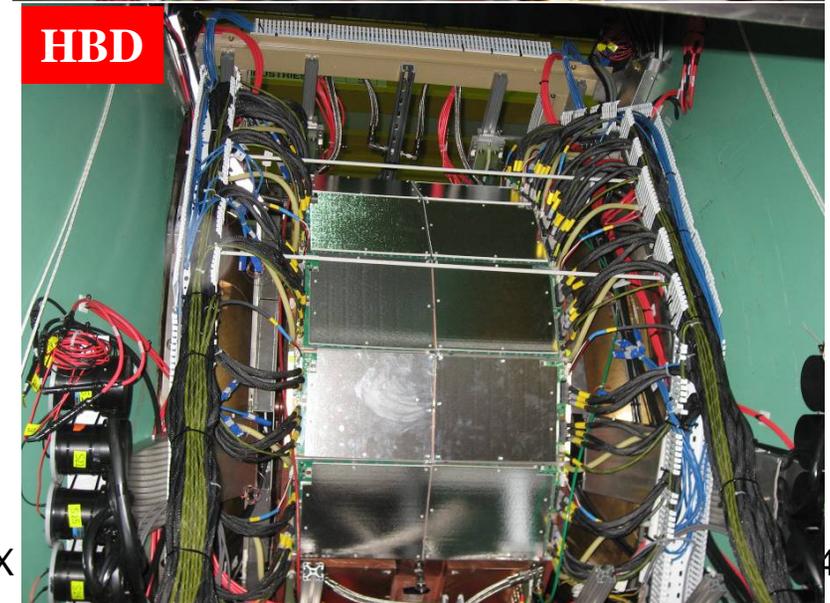
RXNP



MPC-N



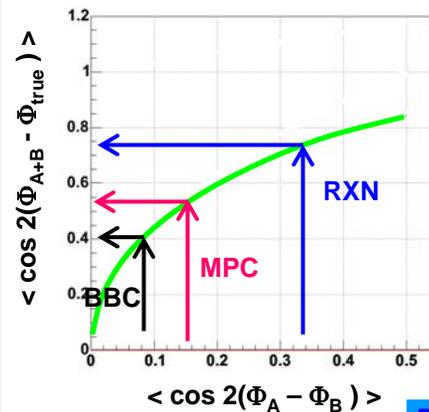
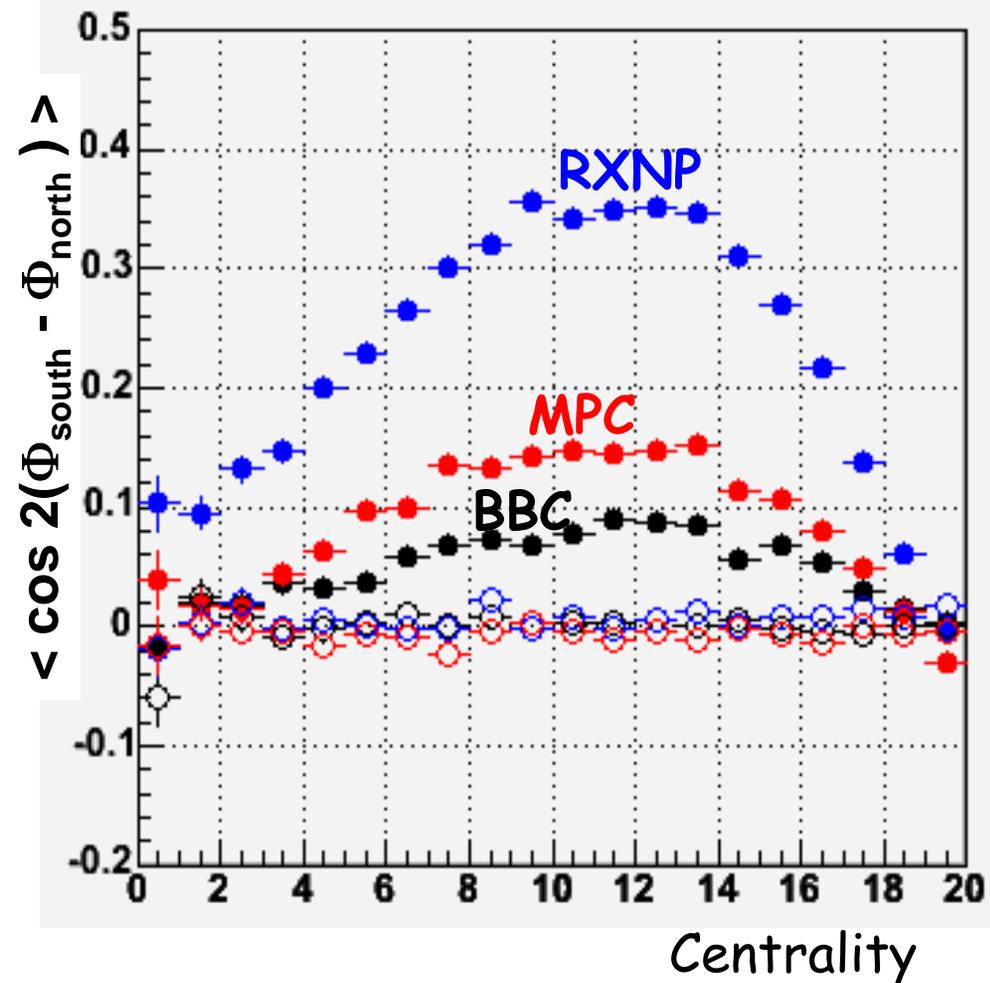
TOF-W



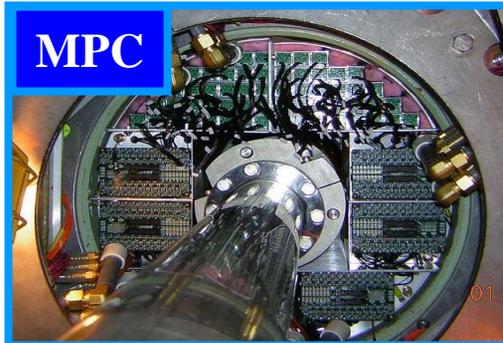
HBD

PHENIX Reaction Plane Measurements Now from MPC, RXNP & BBC

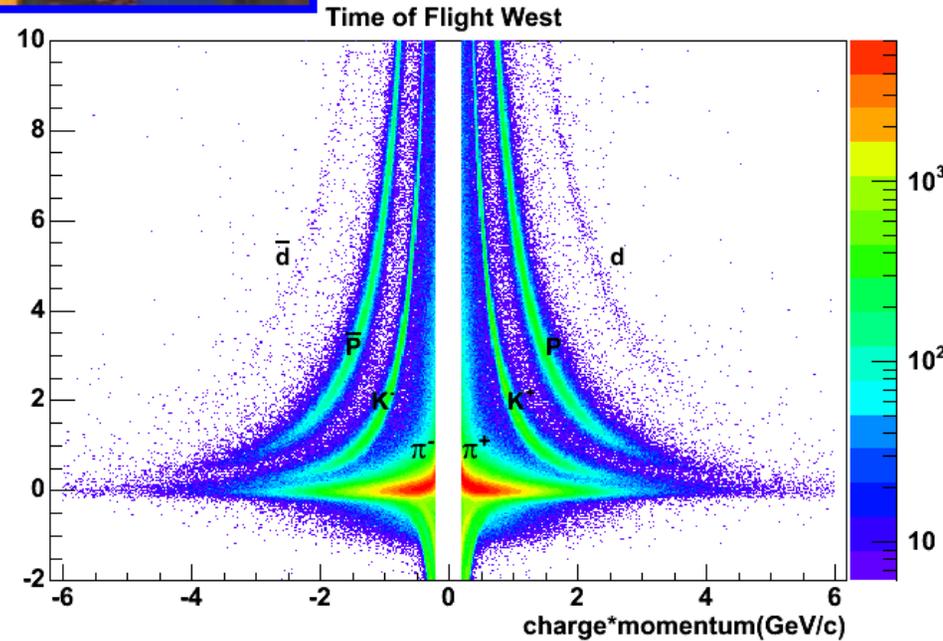
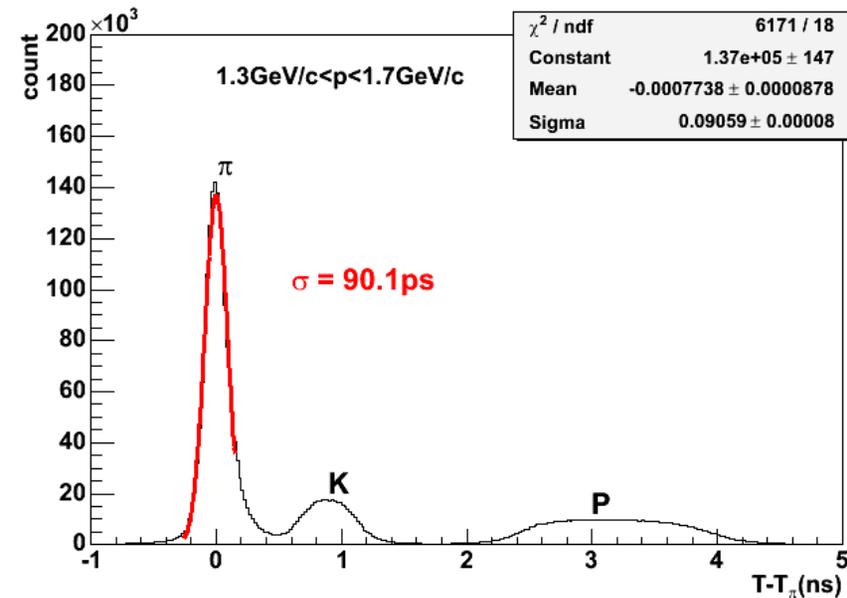
Reaction Plane Detector



$$\delta(v_2^{\text{true}}) = \frac{\delta(v_2^{\text{expt}})}{\sigma_{RP}}$$



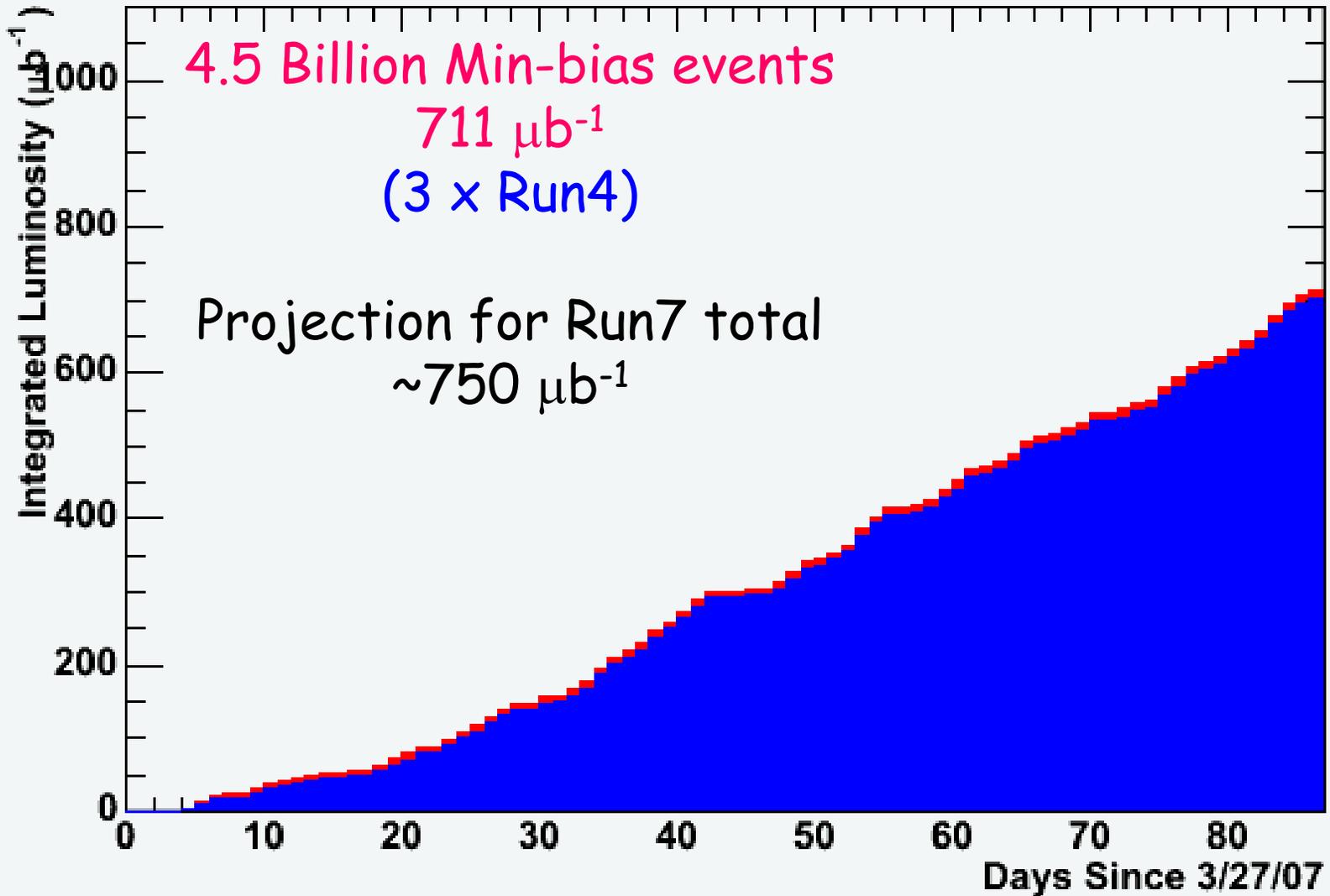
TOF-West Particle Identification



6/21/2007

PHENIX - MJL

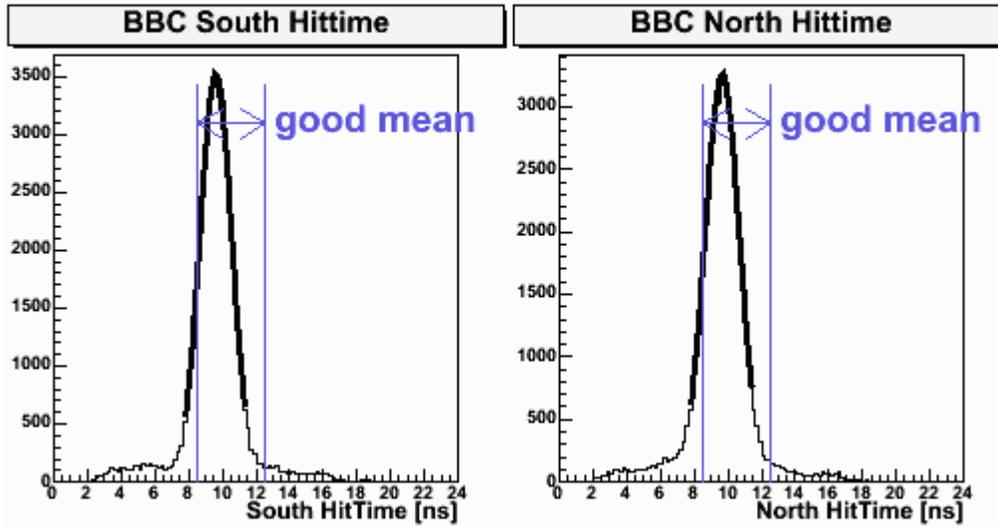
6



Effects of Stochastic Cooling at PHENIX

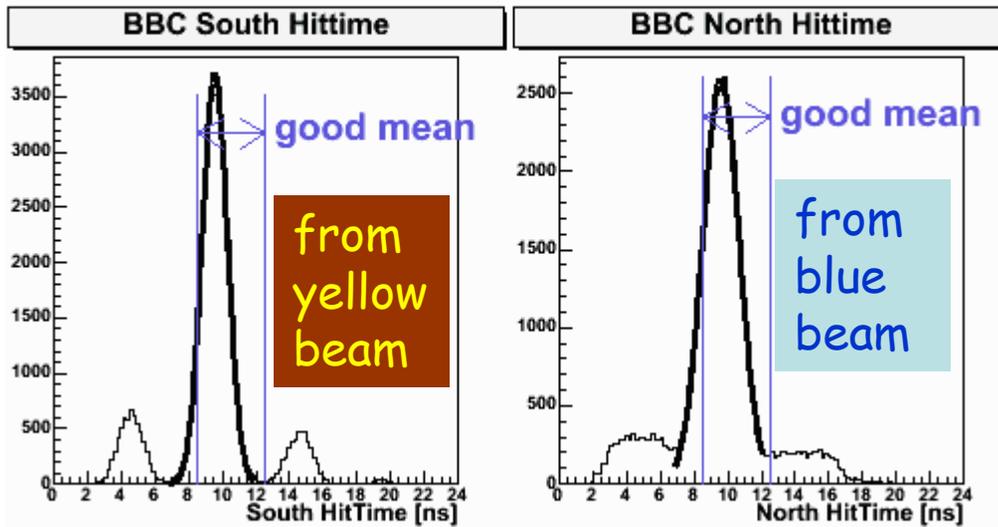
Run #235227 Events: 50172 Date:Wed May 16 22:42:19 2007

beginning
of store



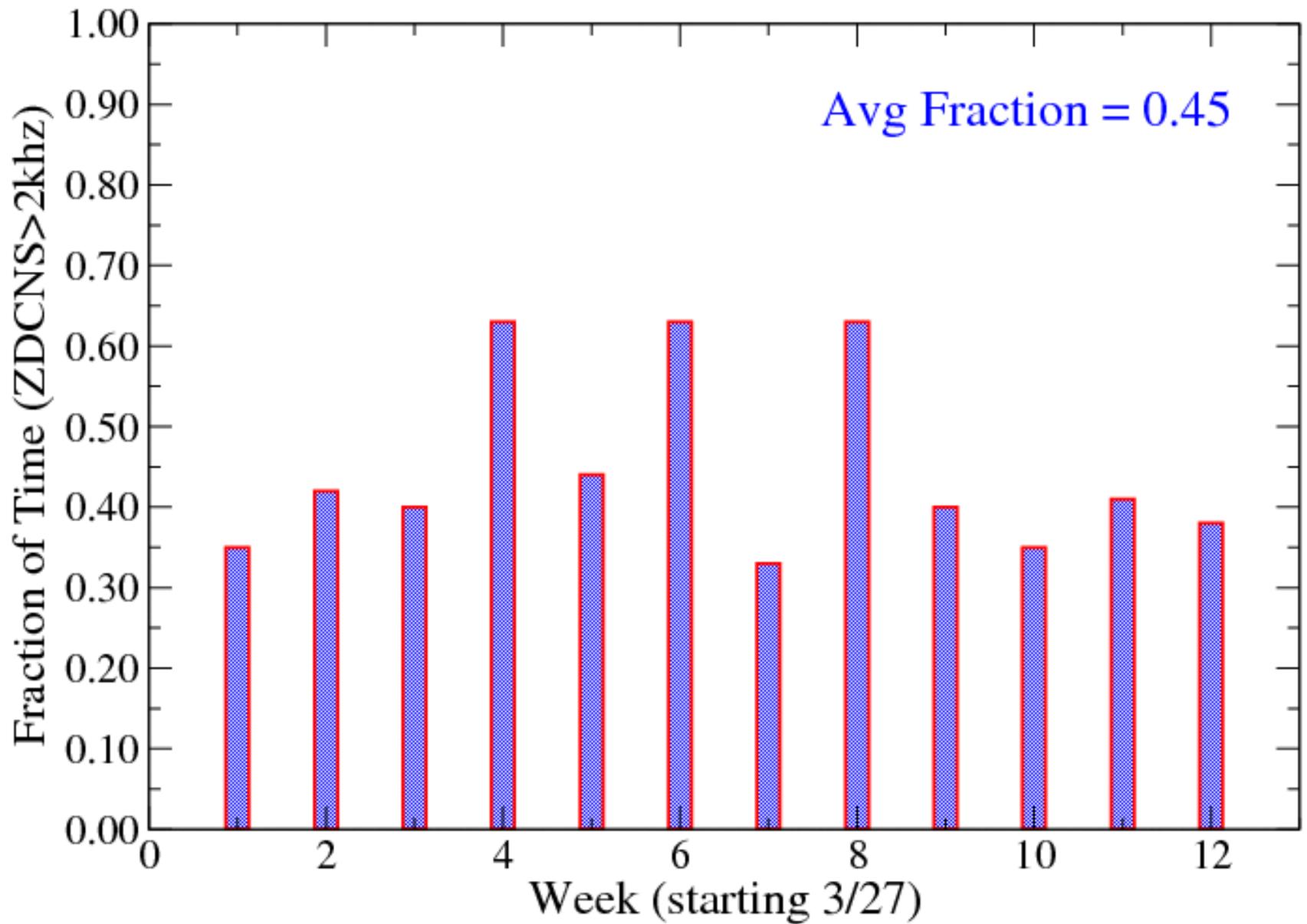
Run #235235 Events: 50136 Date:Thu May 17 02:42:52 2007

end
of store



Improvement in
integrated
luminosity for
PHENIX with
Stochastic
Cooling (SC)

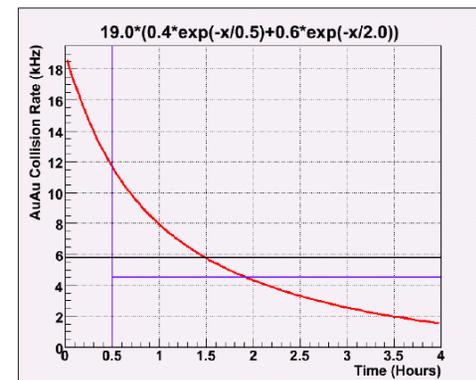
16%



PHENIX Triggering & fast analysis for Run7

Level-1 Triggering just Minimum-Bias (+UPC)

- 5 kHz event rate through DAQ
- only small fraction of integrated luminosity missed due to rates above the DAQ limit in the 1st $\frac{1}{2}$ hour or so of stores



Level-2 filtering in ATP's producing selected, parallel sample of enriched events for fast processing

- $J/\psi \rightarrow \mu\mu$; $J/\psi \rightarrow ee$; high- p_T level-2 triggers
 - 10% of raw data size
 - sent to CCF in France via GRIDFTP
 - analyzed in France for fast results

10% of min-bias events sent to Vanderbilt for fast analysis of min-bias

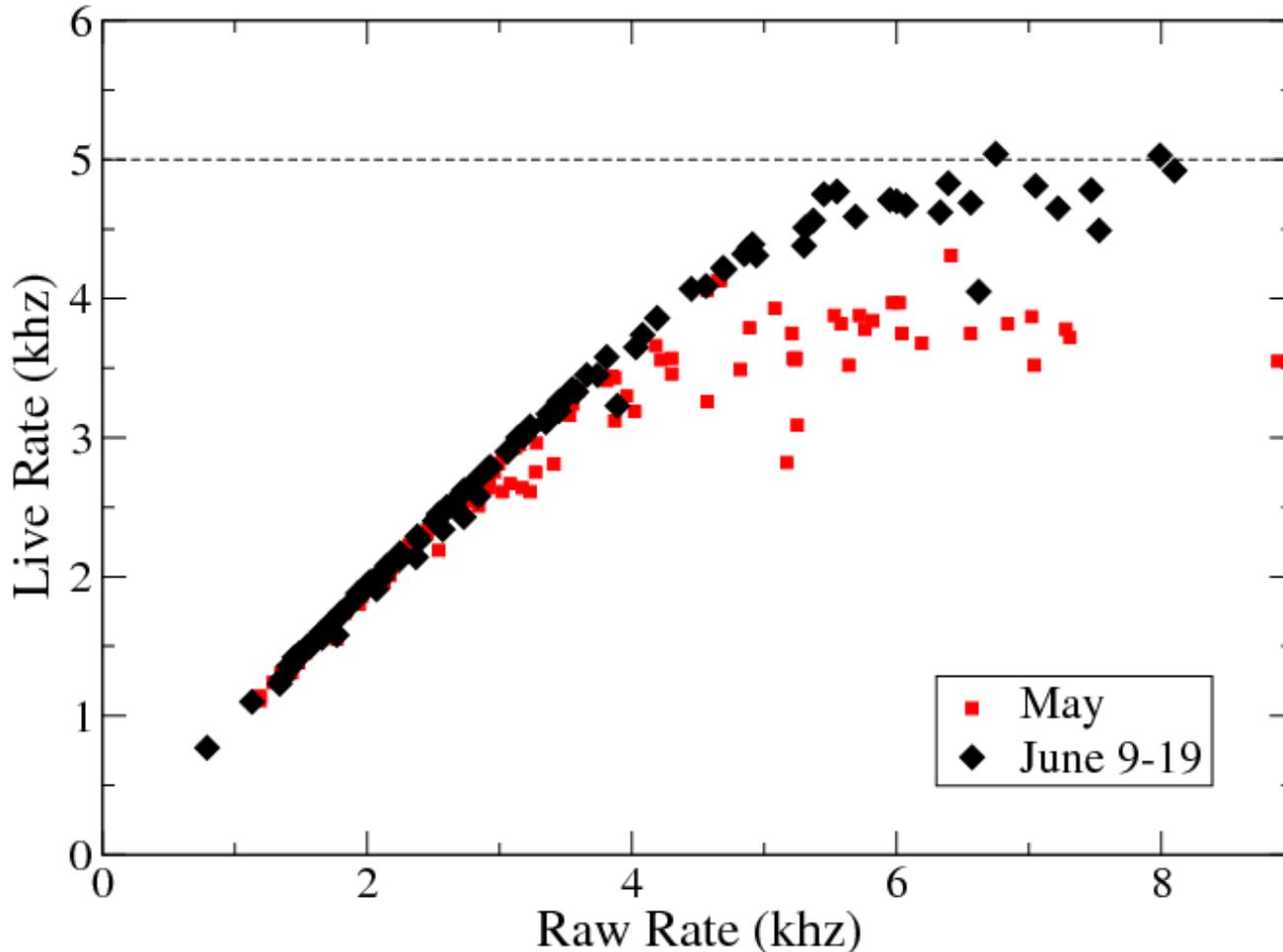
- for physics not provided by level-2 triggers
- & min-bias events needed for mixing, etc to support level-2 analysis

Counting house machines for fast HBD analysis

PHENIX Data Acquisition (DAQ)

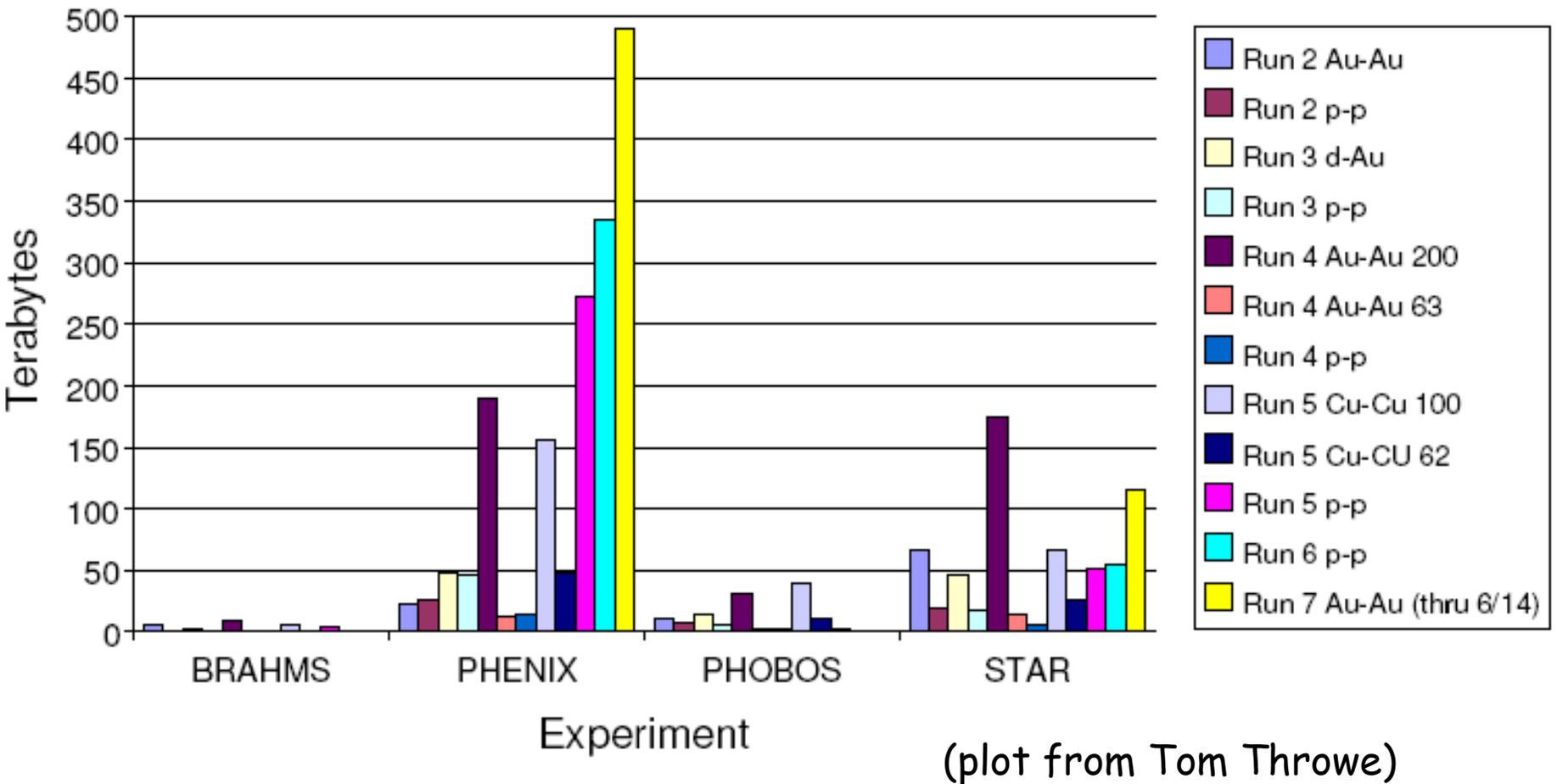
Present DAQ performance:

- up to 5 khz event rate & 700 Mb/sec throughput



- DAQ Advances:
- level-2 code speedup
 - additional buffer box
 - fix SEB memory leaks
 - more compact HBD data format
 - etc

Raw Data Collected in RHIC Runs

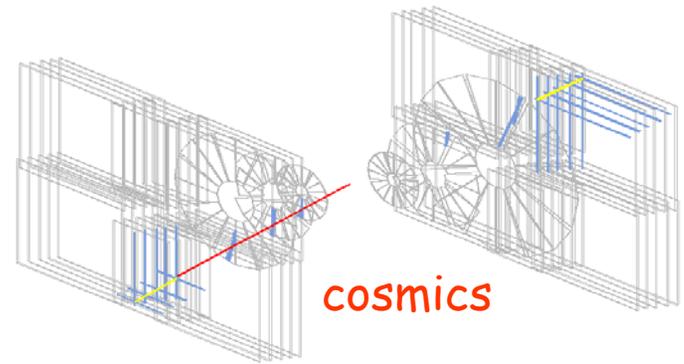
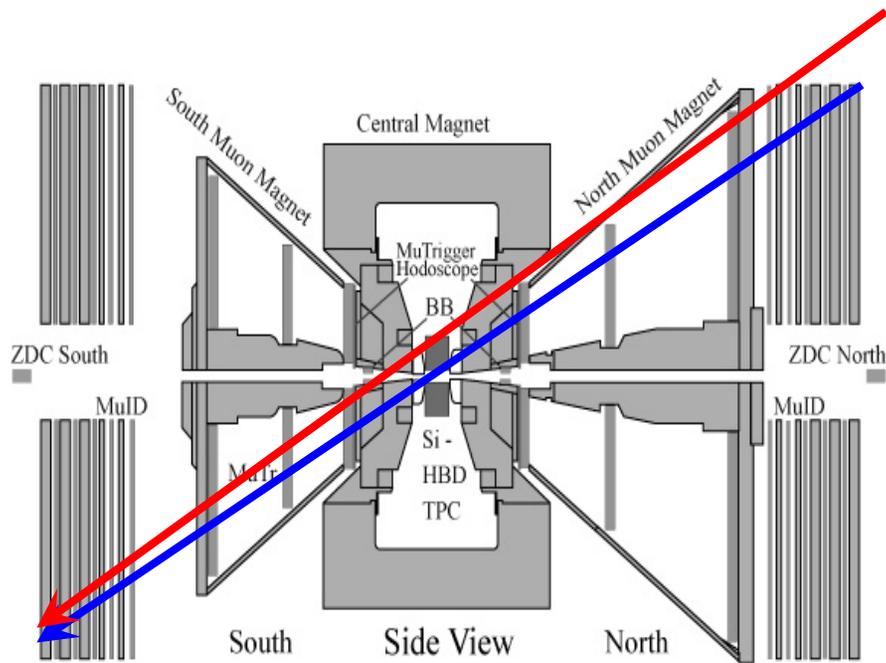


PHENIX Shakedown/Cosmic Ray Running (Jan & Feb)

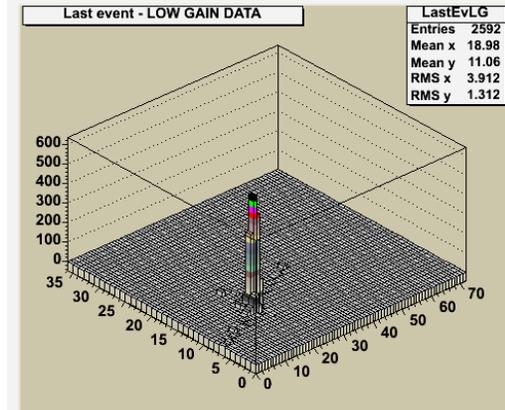
Need Cosmic Ray background measurement for W physics

• Cosmic/ W estimated to be 1/1 for $p \geq 10$ GeV, but estimate is unreliable - need measurement!

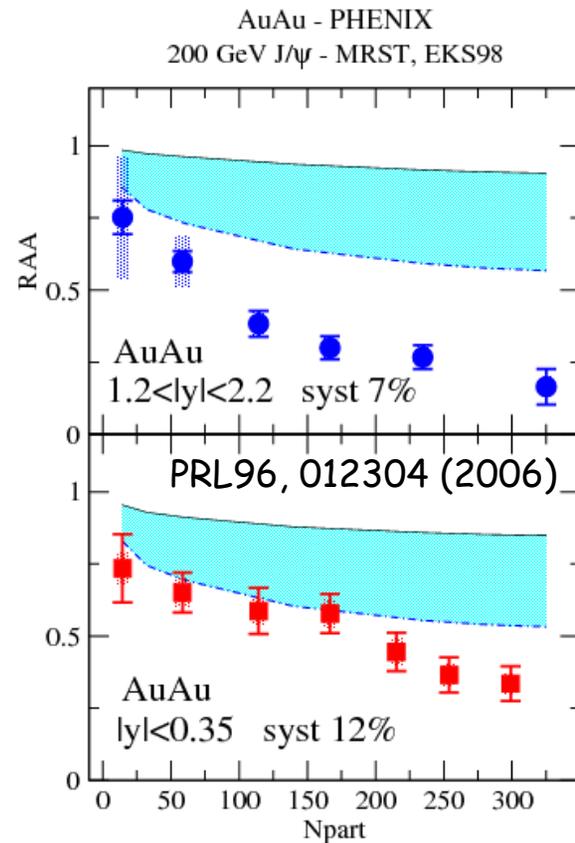
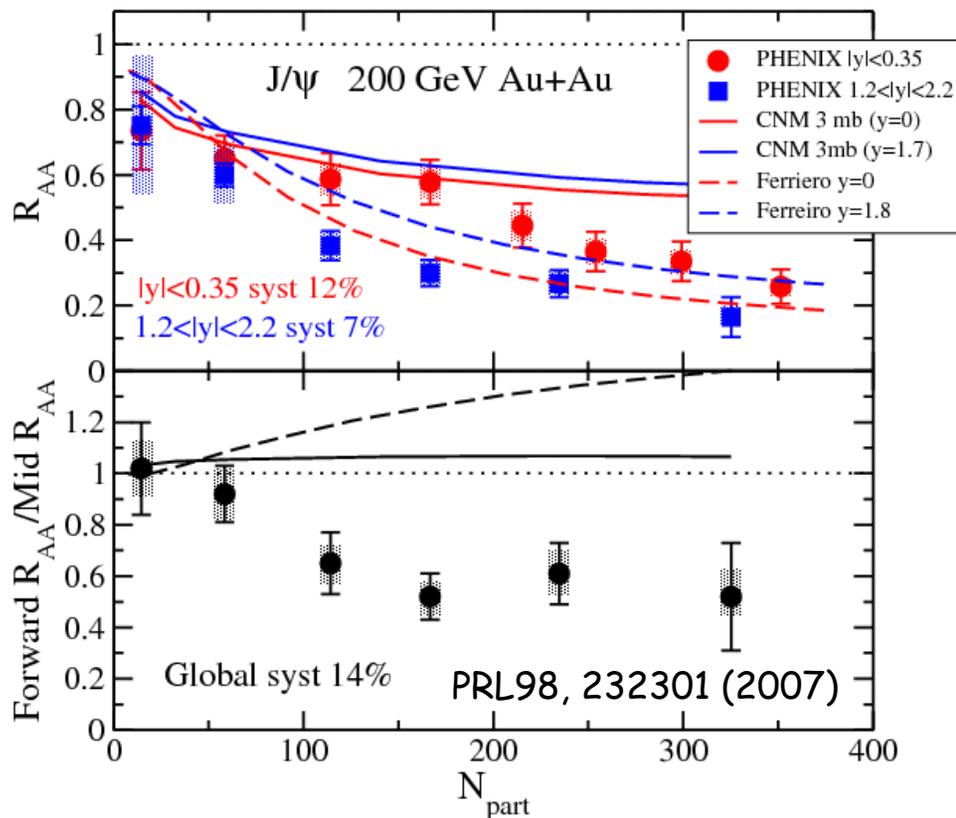
Also Cosmic ray in EMCal looks much like high- p_T photon



Event in EMCal Sector W_0

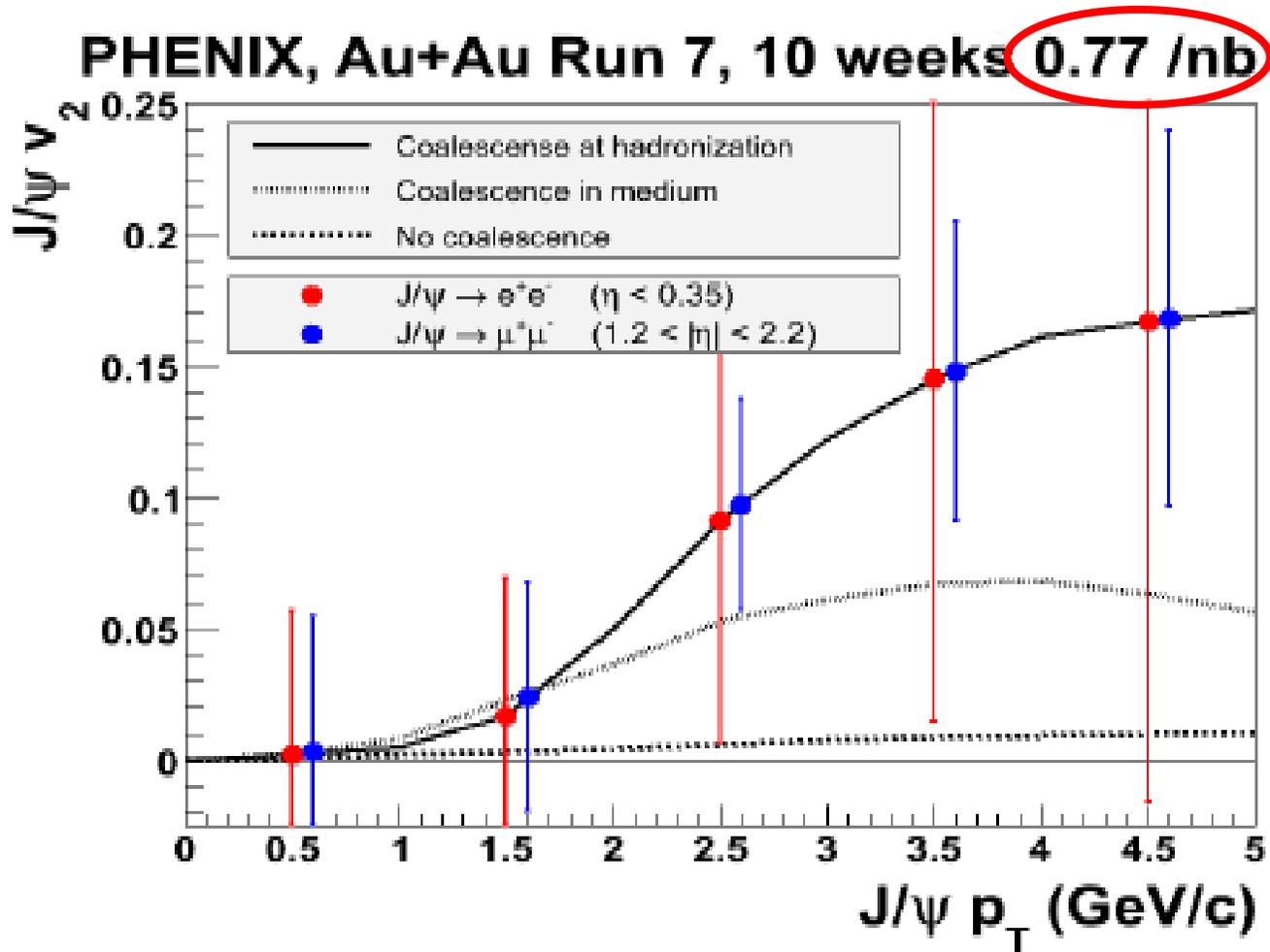


J/ ψ 's in AuAu Collisions at PHENIX



Statistical & systematic precision of new Run7 AuAu data will improve this picture - But will also benefit enormously from new dAu data that can constrain the cold nuclear matter baseline accurately

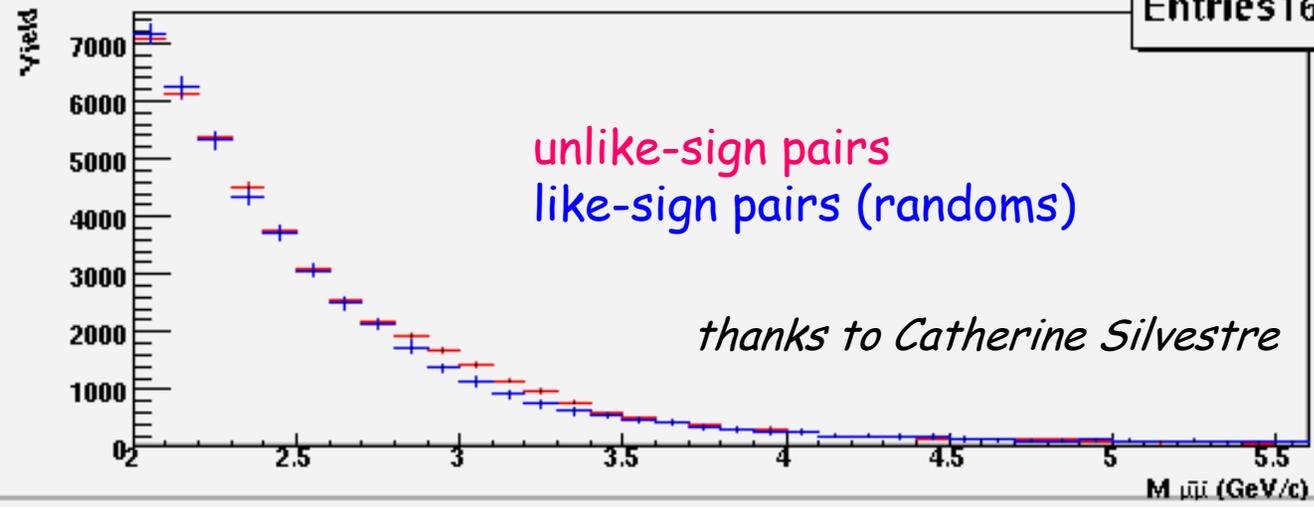
Expected Results for J/ψ flow from Run7



From Tony Frawley, heavy PWG, Jan 4th

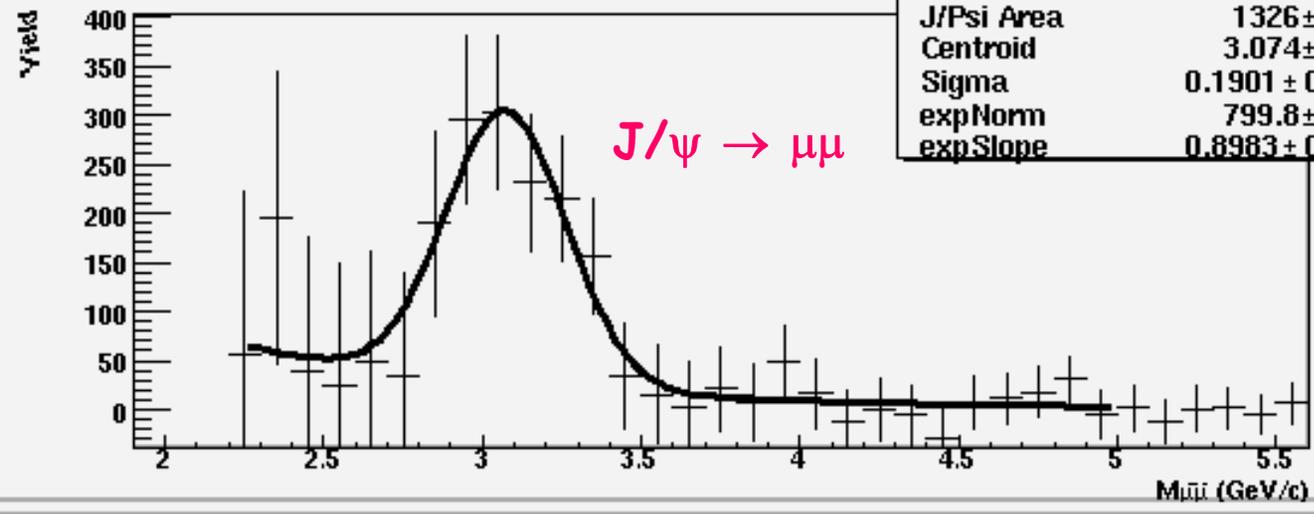
dimuon mass (+)

Entries 163306



dimuon mass (signal)

Entries	163256
J/Psi Area	1326 ± 287.0
Centroid	3.074 ± 0.036
Sigma	0.1901 ± 0.0500
expNorm	799.8 ± 796.2
expSlope	0.8983 ± 0.2087



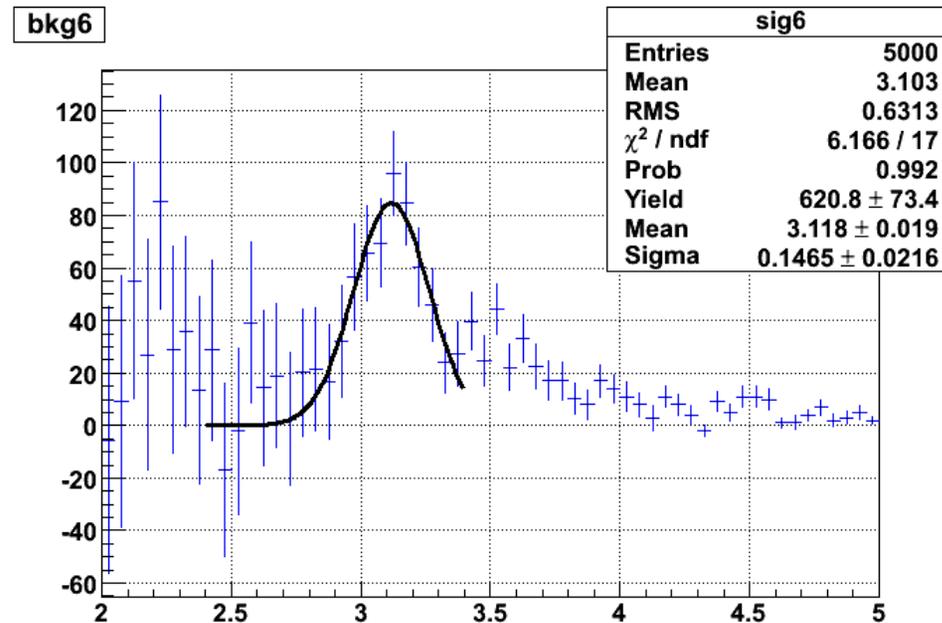
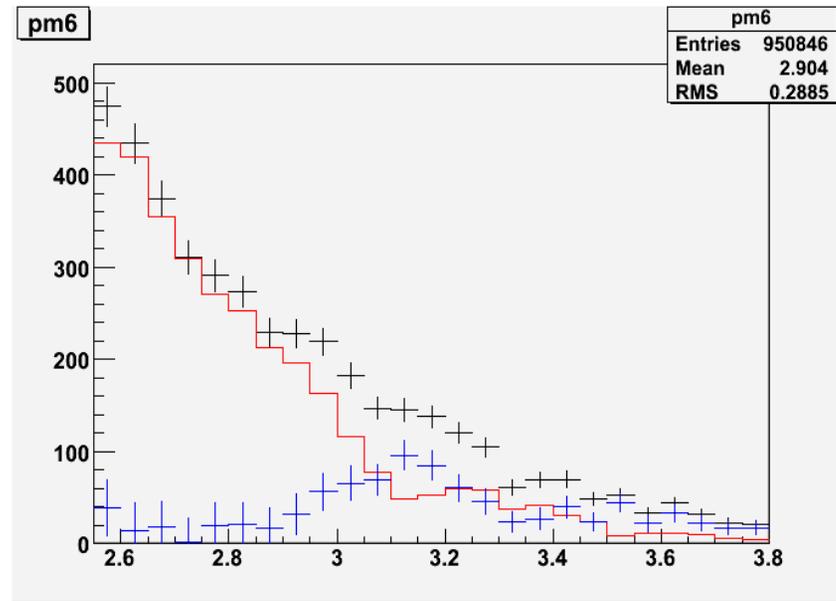
for ~8% of present Run7 integrated luminosity
 (~16,000 $J/\psi \rightarrow \mu\mu$ for present luminosity sum)

$J/\psi \rightarrow ee$

for roughly
 $60 \mu\text{b}^{-1}$

scales to
5,000 or
more J/ψ
for present
luminosity

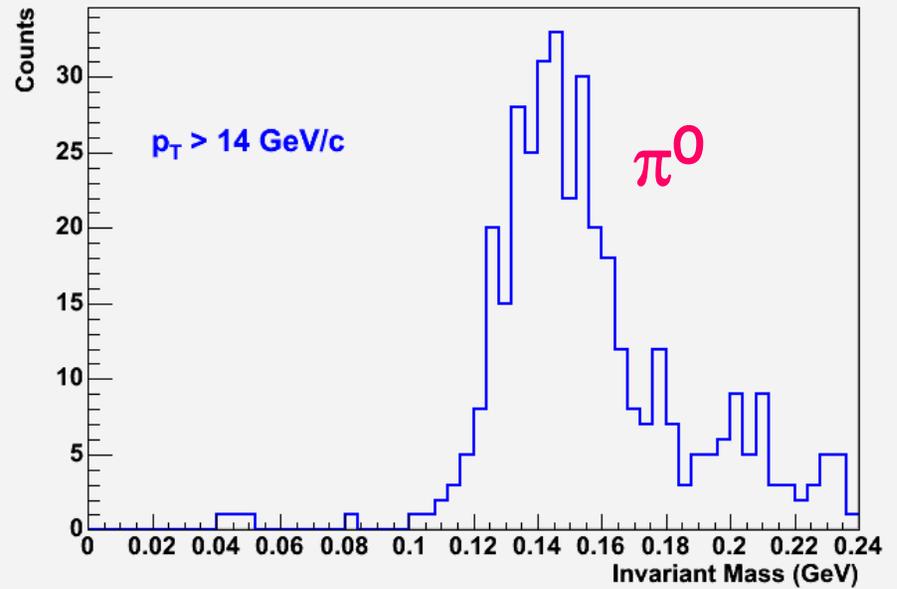
thanks to
Ermias
Atomssa



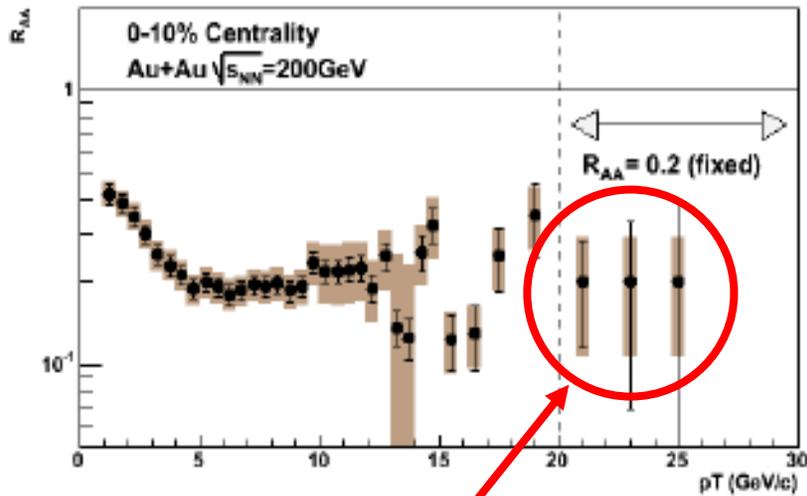
π^0 's & η 's

thanks to Justin Franz

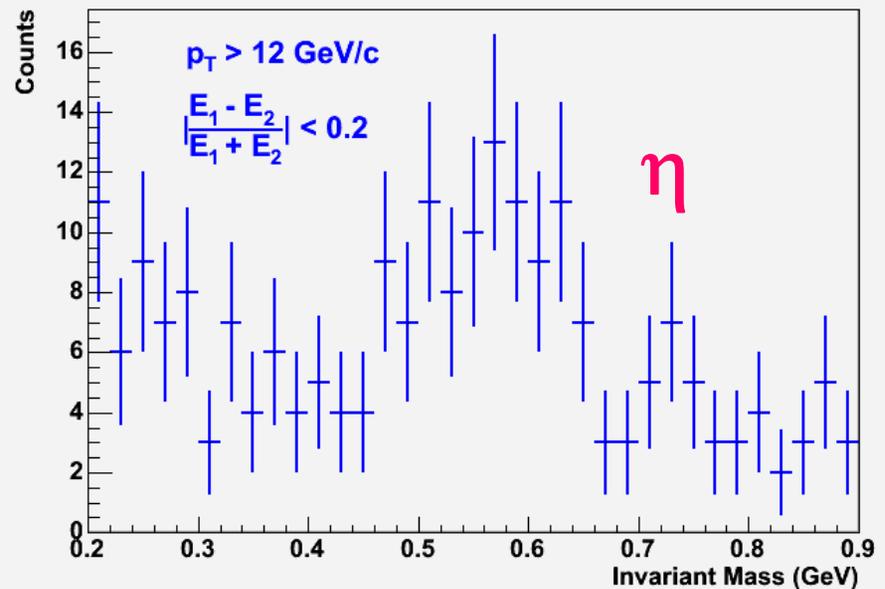
from about 16% of present data



$\pi^0 R_{AA}$ with 4x statistics

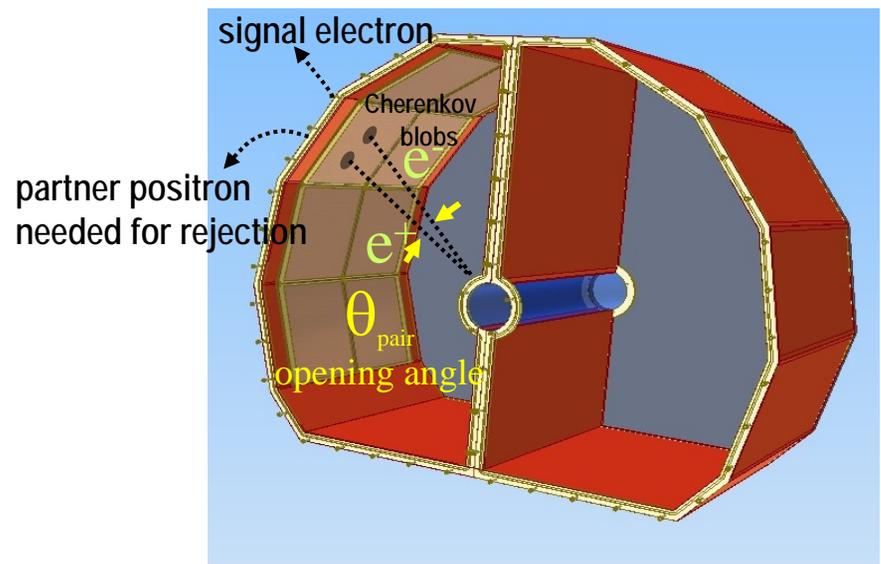
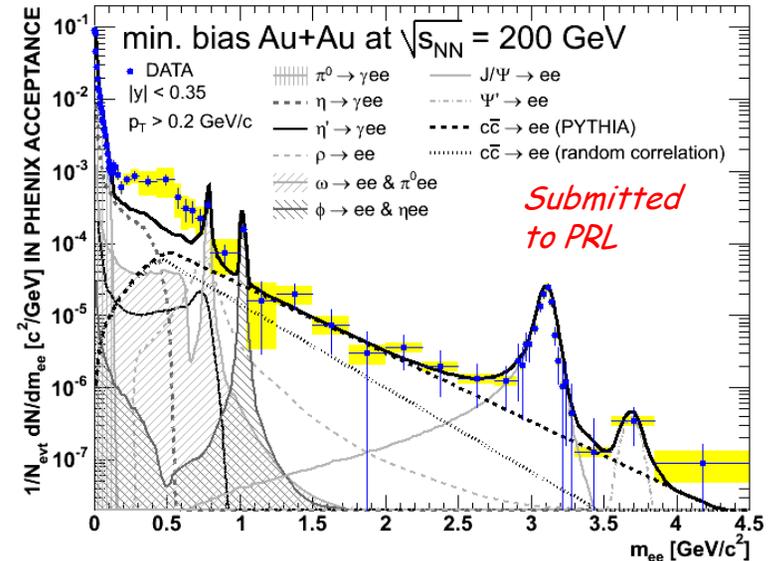


extended range in p_T



Hadron Blind Detector (HBD)

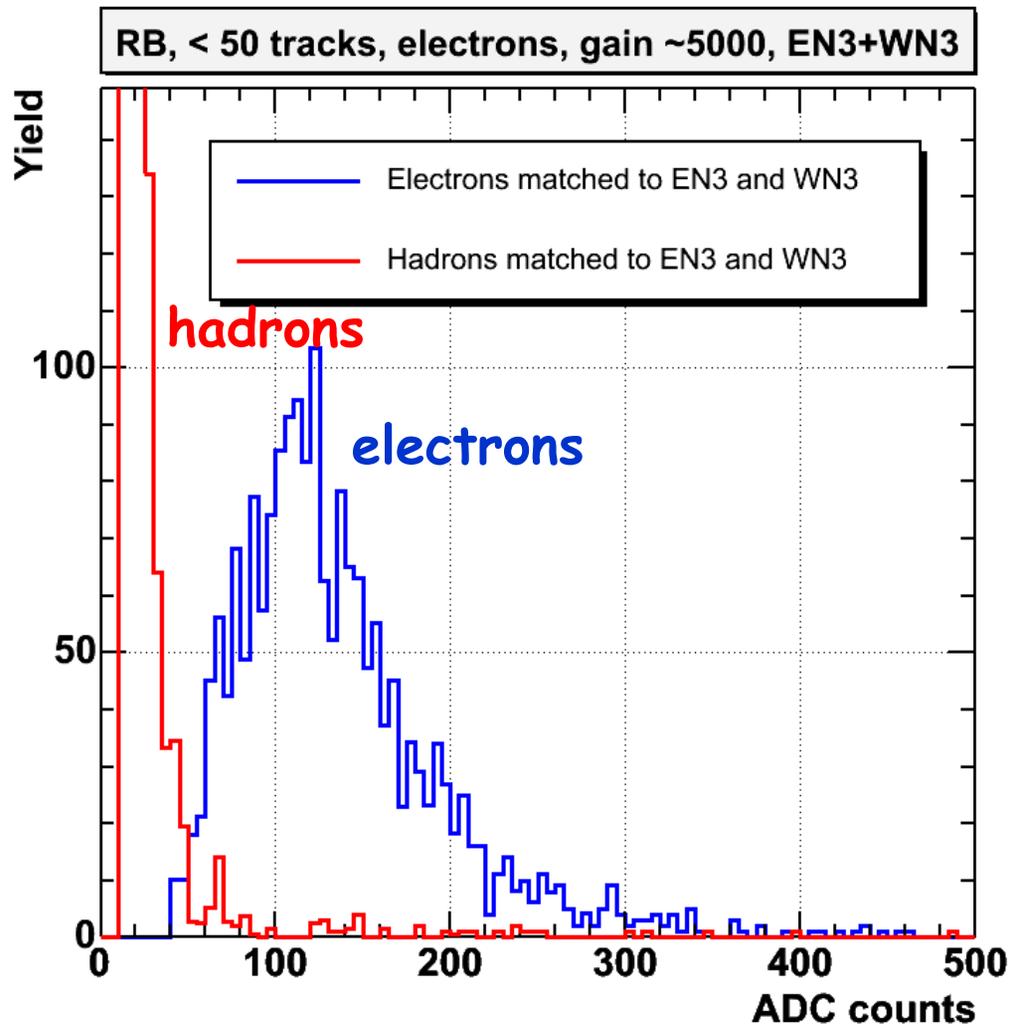
- A "hadron-blind" detector to detect and track electrons near the vertex."
- Dalitz rejection via opening angle
 - Identify electrons in field free region
 - Veto signal electrons with partner
- HBD: a novel detector concept:
 - windowless CF_4 Cherenkov detector
 - 50 cm radiator length
 - CsI reflective photocathode
 - Triple GEM with pad readout
- *The HBD will improve our S/B by a factor of ~100*



Hadron Blind Detector (HBD)

West side of HBD taken out
Apr 25th for repairs

- HV trips with large stored energy damaged detector
- Now being refurbished with new GEM's & fixed HV
- $\frac{1}{2}$ of the East side of HBD still in

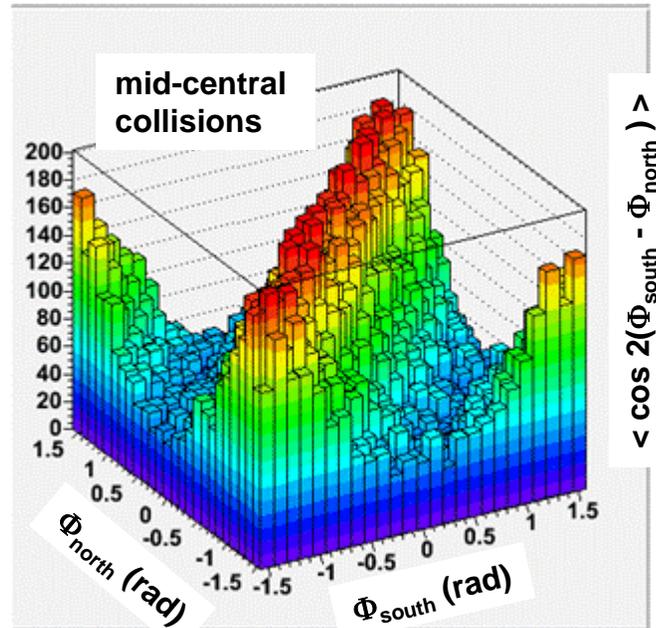
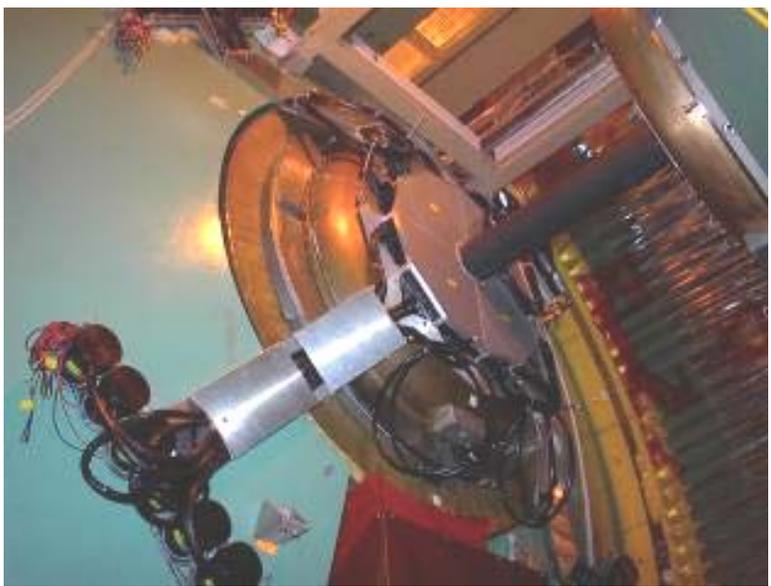
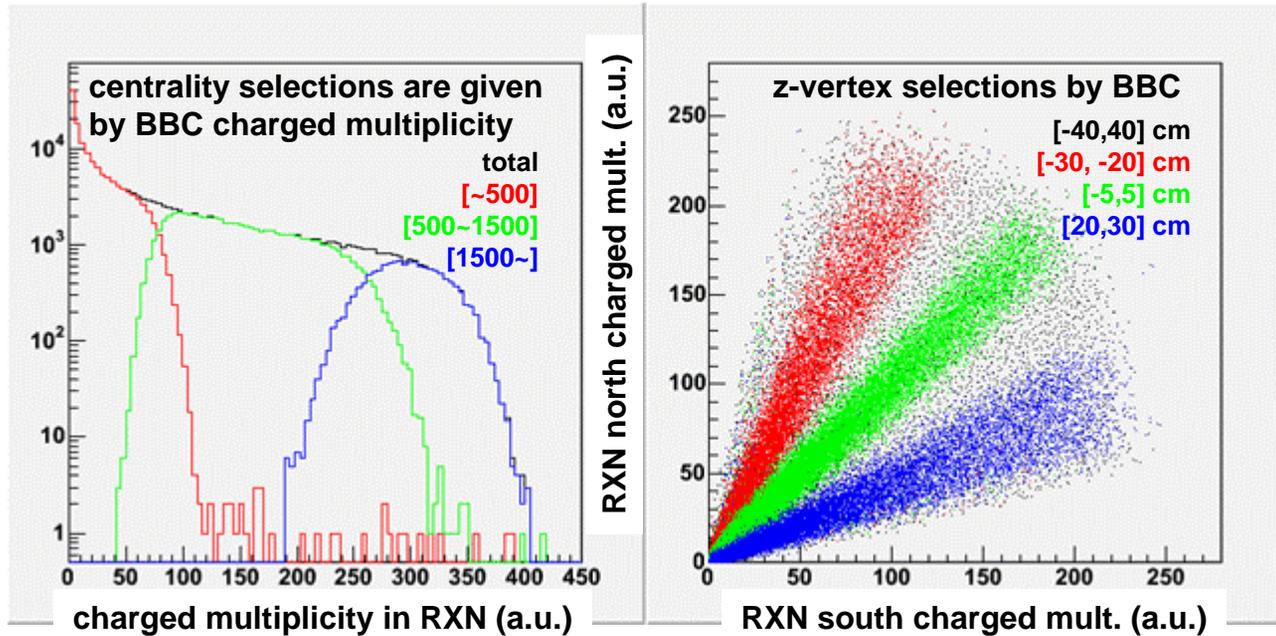


Concluding Remarks

- Near 3 times Run4 luminosity ($\sim 750\mu\text{b}/241\mu\text{b}$) PLUS new capabilities from new detectors - major advances in our physics should result
- Analysis in progress already thanks to level-2 filtering & mature analysis model
- HBD a very state-of-the-art detector, but lessons learned in Run7 should allow full operation in Run8 & beyond
- Excellent stores when they could be delivered, but too many breakdowns
 - Stochastic cooling - a step towards the future
 - Low energy (9.2 GeV) running feasible
- Thanks to our CA-D colleagues for all their unending work to keep us & the machine working!
- And of course to all my colleagues on PHENIX who were the ones who really made things work at the counting house

Backup

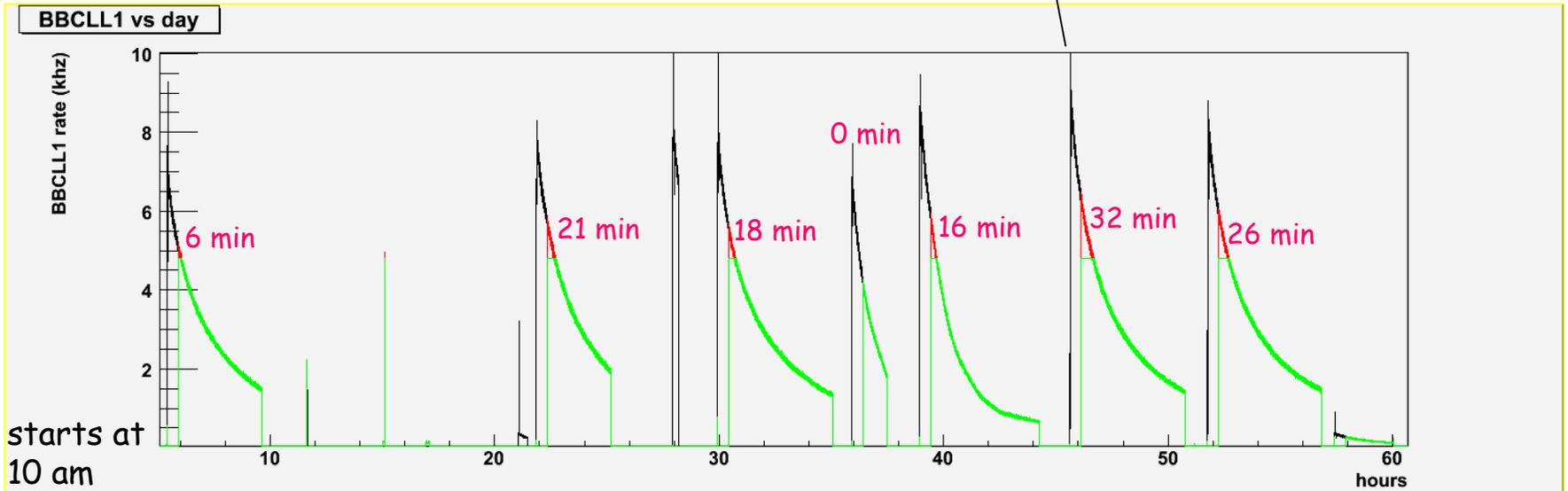
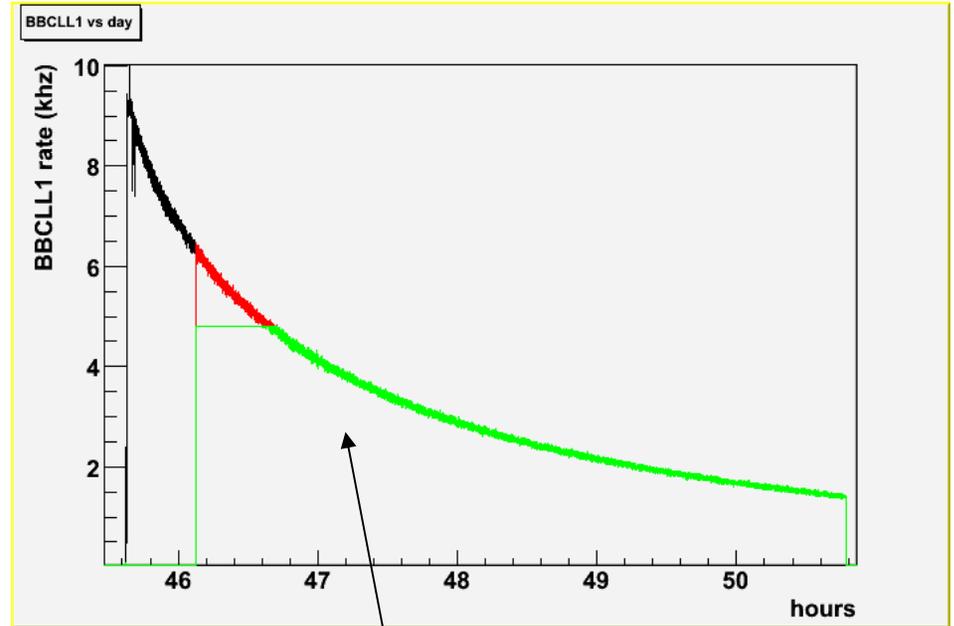
**PHENIX Reaction Plane
Detector (RXNP)**
200GeV Au+Au collisions
RUN7 - 2007/Mar



Luminosity fraction captured by PHENIX DAQ saturation in red

Fraction of luminosity for late April stores (at bottom) 97.8% for 4.8 khz DAQ rate

- for $\frac{1}{2}$ hr turn-on time



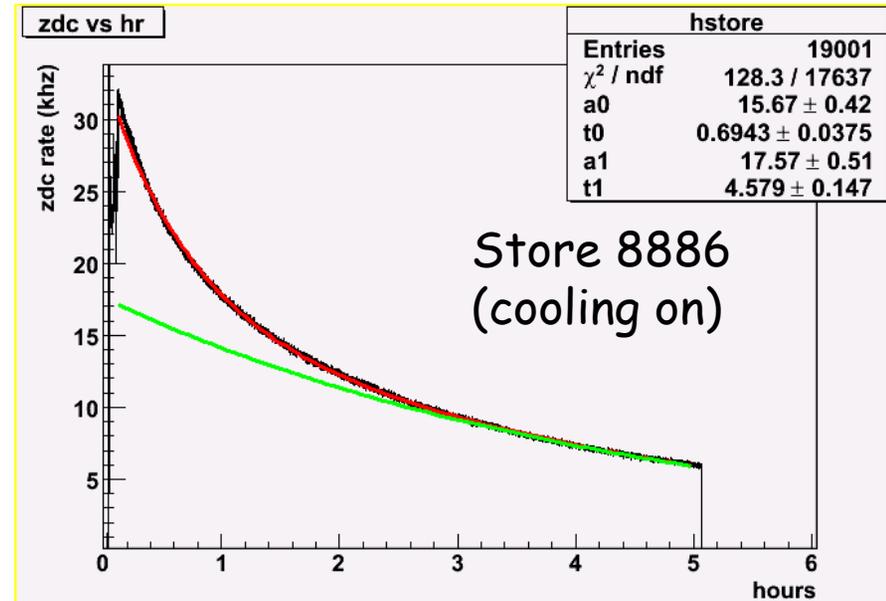
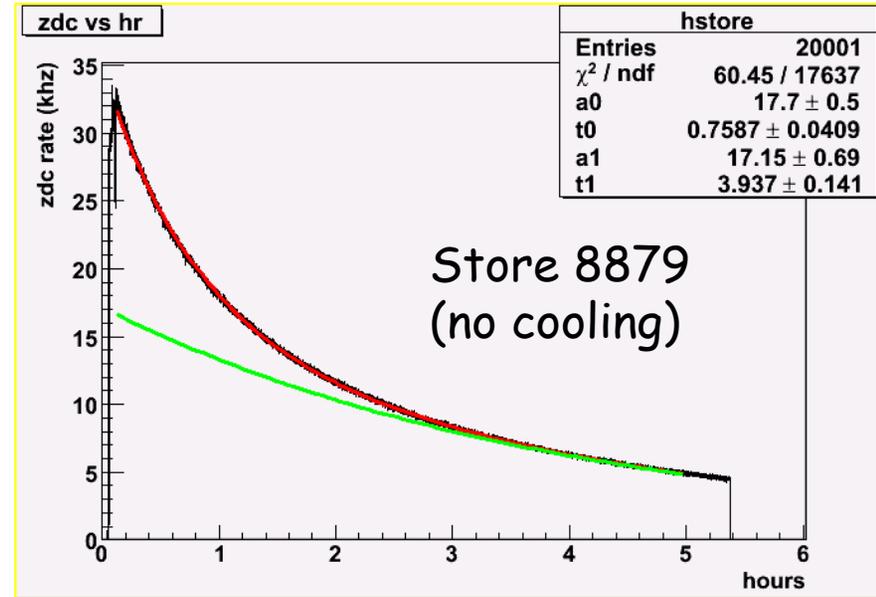
Fri Apr 27th
6/21/2007

Improvement in integrated luminosity for PHENIX with Stochastic Cooling (SC)

date	time	store	cooled	$\mu\text{b}^{-1}/\text{hr}$	Zdc (pk)	FM ($\times 10^{-3}$)
5/15	2:10	8776	no	0.9804	34.97	28.04
5/30	2:10	8875	no	0.8789	32.07	27.41
5/30	23:50	8879	no	0.9746	34.85	27.97
5/19	14:47	8805	yes	1.1524	35.19	32.75
5/25	16:30	8849	yes	0.9874	30.34	32.54
6/1	8:00	8886	yes	1.0530	33.24	31.68

Average Improvement with SC:

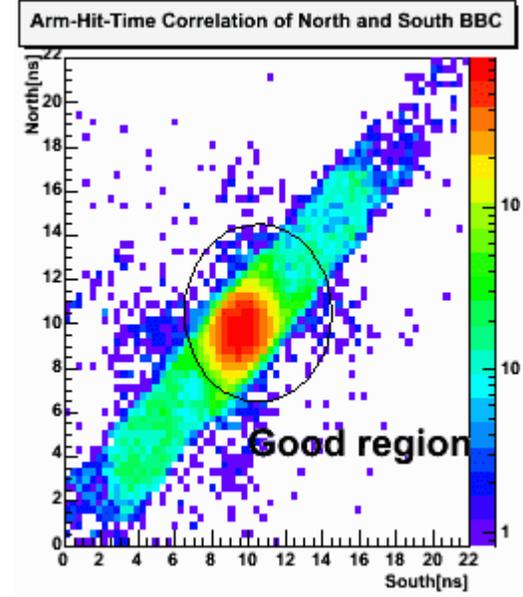
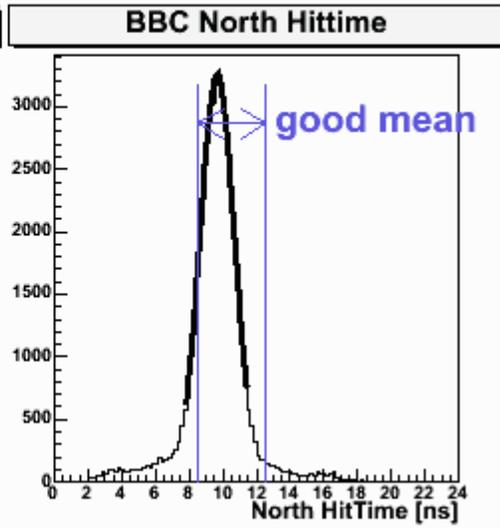
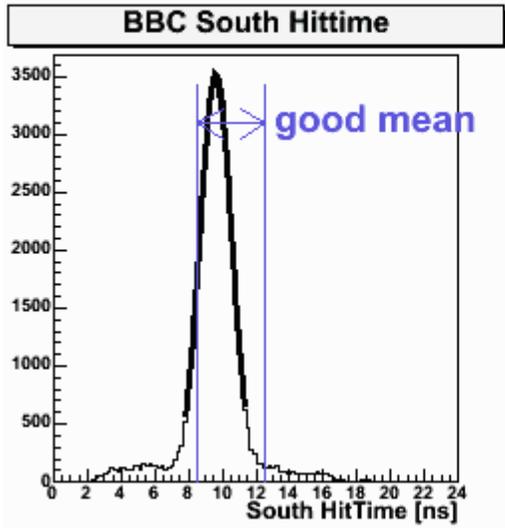
$$\frac{32.32 \pm 0.57}{27.81 \pm 0.35} = 1.16 \pm 0.03$$



Effects of Stochastic Cooling at PHENIX

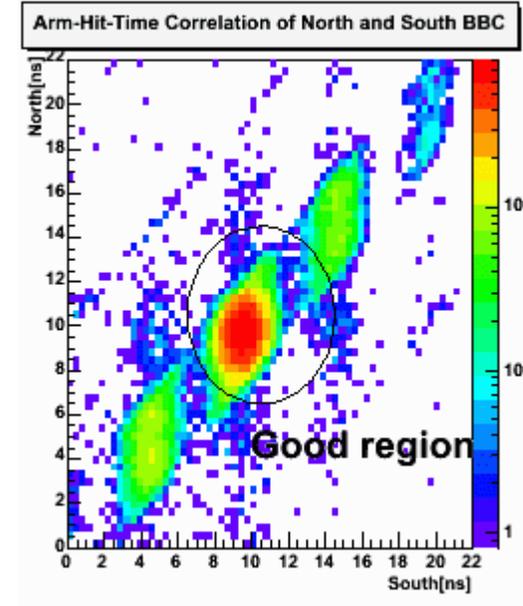
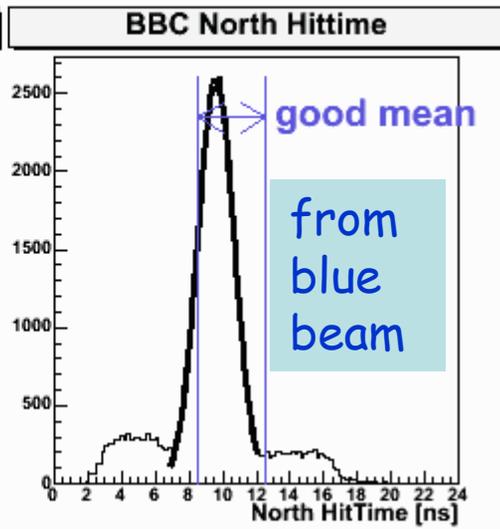
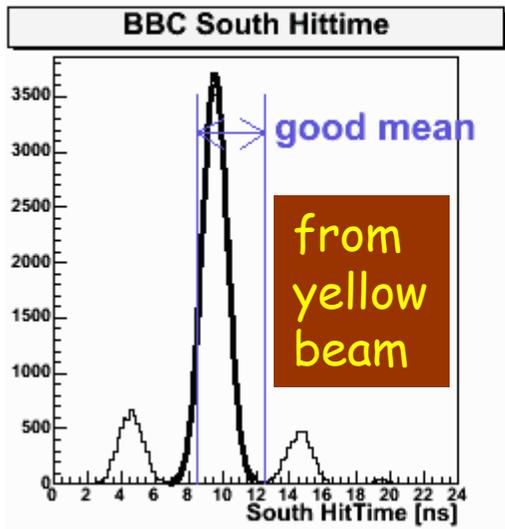
Run #235227 Events: 50172 Date:Wed May 16 22:42:19 2007

beginning
of store



Run #235235 Events: 50136 Date:Thu May 17 02:42:52 2007

end
of store



6/21/2007

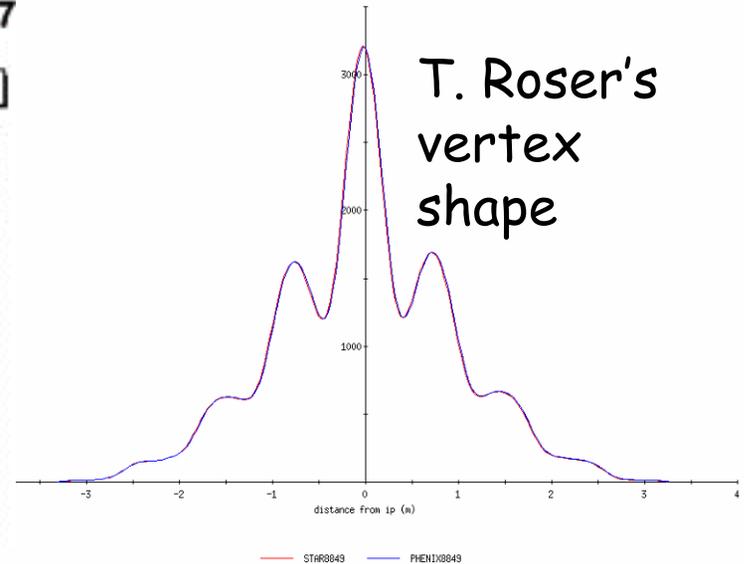
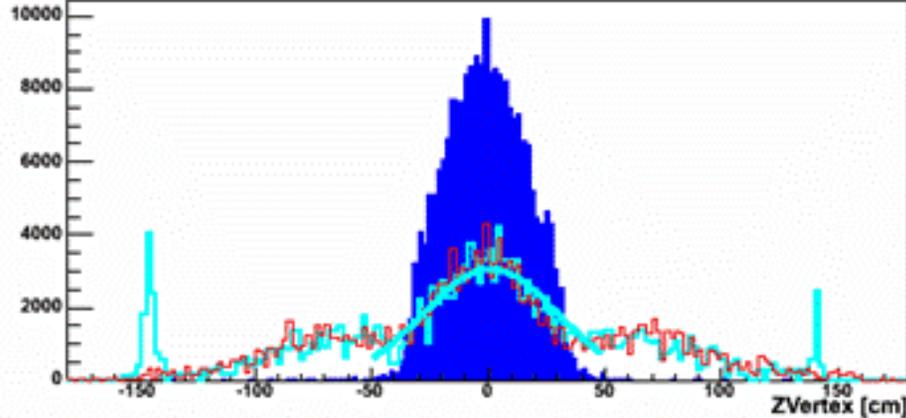
PHENIX - MJL

Differentiation of vertex into distinct peaks due to Stochastic Cooling

BBC ONLINE MONITOR

Run #238332 Events: 94473 Date:Sun Jun 10 05:20:08 2007

Bbc ZVertex (south<-->north)



ZDC vertex (ZDC Wide)

BBC vertex (BBC no vertex cut)

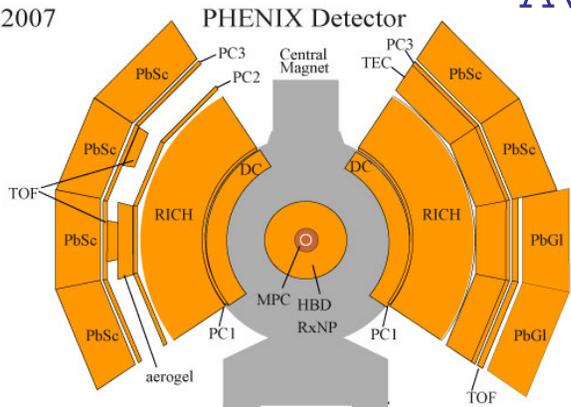
BBC vertex (BBC ± 30 cm vertex cut)

Vanderbilt Farm

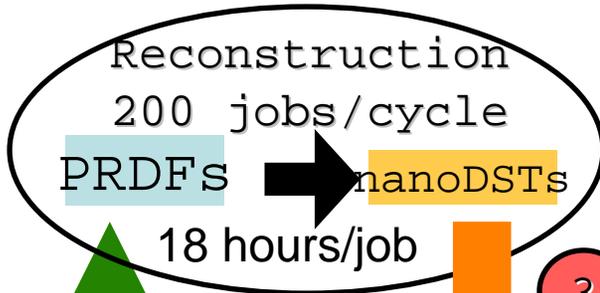
1600 CPUs, 80 TBytes disk



2007



45TB and 200 CPUs
Available for Run7 Reconstruction



RCF
RHIC computing facility



1
PRDFs
Raw data files
GridFTP to VU
30 MBytes/sec

FDT
45
MB/s

770 GBytes
per cycle

3
FDT
45
MB/s

2

Dedicated GridFTP Serv
Firebird
4.4TB of buffer disk space

4
nanoDSTs
Reco output to RCF
GridFTP 23 MB/sec

June 13, 2007

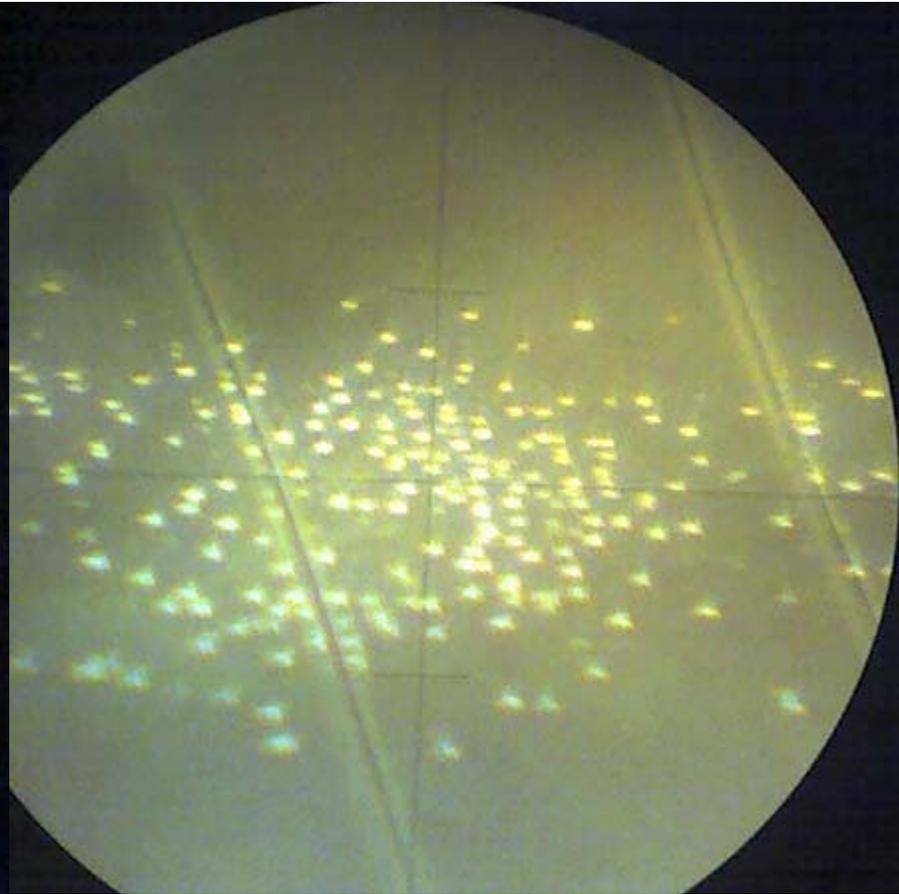
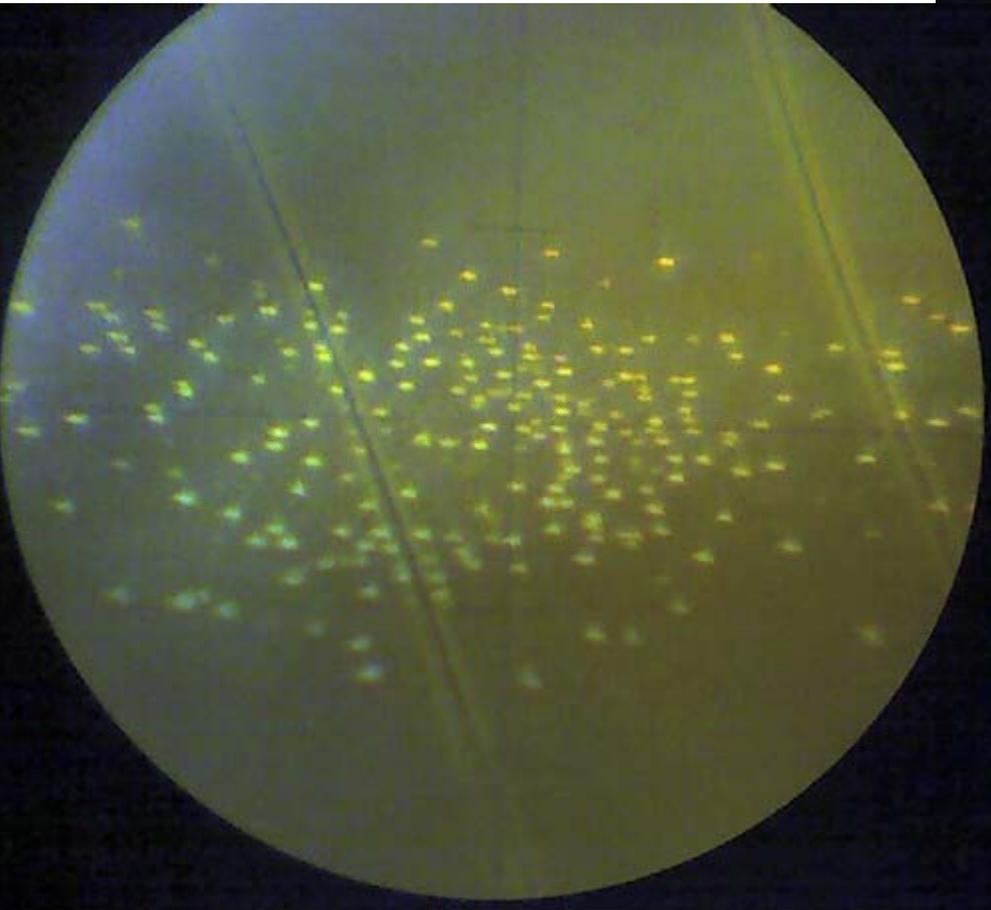
HBD Status

- We believe we have determined the main cause of the sparking problems with the both detectors:
 - Normal GEM spark would cause Lecroy HV to trip
 - Mesh also trips leaving large stored energy on filter capacitor
 - As GEM voltage goes to zero, large DV develops across gap between top GEM and mesh, ultimately resulting in a large spark
 - This spark induces sparks in other GEMs (massive trips) by propagation of scintillation light

There is however a danger in the "One source of all troubles" theory and we are still looking for more possible causes of the problems we had during the run

from
T.Hemmick

Pock Marks



- Human eye could see the holes.
- Holes smaller than pock parks.
- Pocks almost certainly from mesh → GEM

from
T.Hemmick

Low Energy Running at PHENIX

- 9.19 GeV/nucleon
- PHENIX RXNP trigger
 - timed in at full energy
 - expect ~96% efficiency (compared to ~15% for BBC)
 - ZDC trigger should be very inefficient due to large Fermi motion wrt longitudinal momentum
- Wednesday afternoon could run our DAQ with the "blue low-energy clock"
- But Thursday morning, when beam was in the rings, we could not
- Presumably due to glitches in the clock (associated with other clock events that were not there on Wednesday??)

