

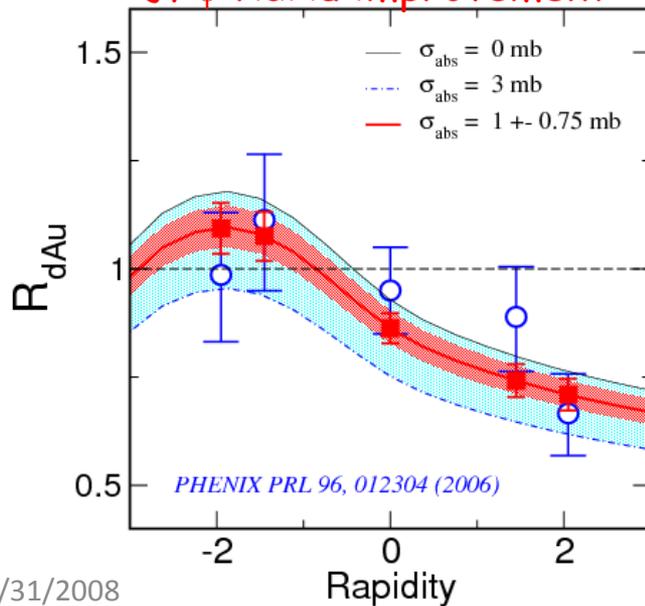
PHENIX Run8 Summary - Mike Leitch

PHENIX Run Coordinator

- Luminosity & Overall Performance
- Critique
- Spin goal reality check
- Vertex efficiency issues
- J/ψ Signals
- Low Energy Au+Au

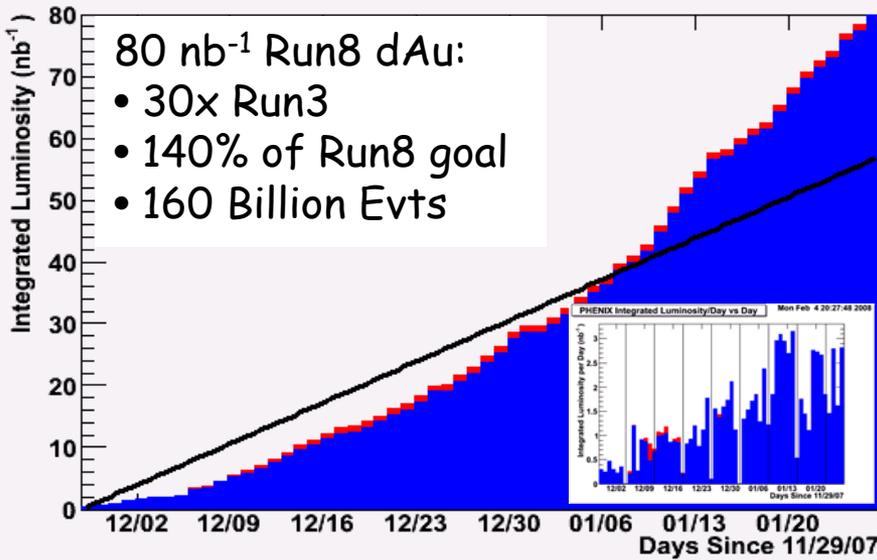


Projected Run8 dAu
 J/ψ RdAu improvement



PHENIX Integrated Luminosity vs Day

Mon Feb 4 20:27:48 2008



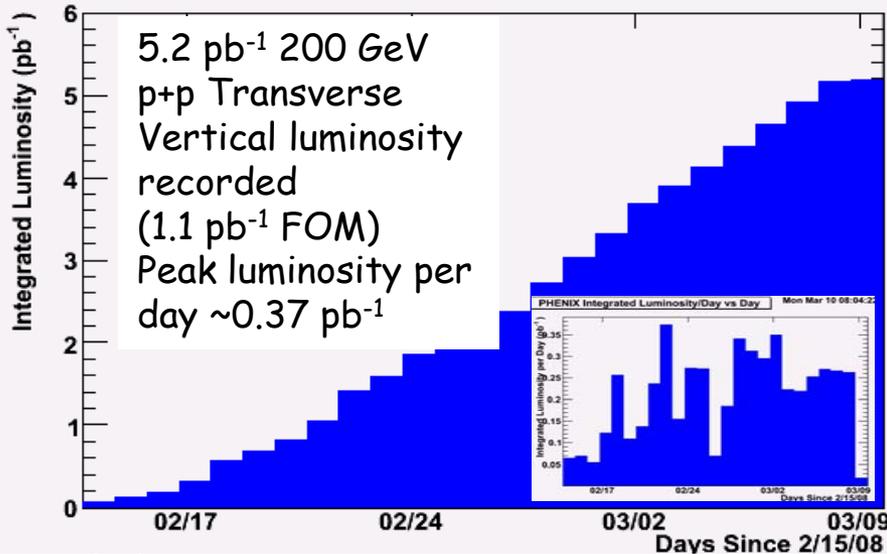
dAu

- peaks above 3 nb⁻¹ per day
- one day > total Run3 luminosity of 2.7 nb⁻¹

pp - almost no progress on luminosity & polarization development towards future

PHENIX Integrated Luminosity vs Day

Mon Mar 10 08:04:2



Run	Energy	Long.	Trans.
02	200 GeV		0.15 pb ⁻¹
03	200 GeV	0.35 pb ⁻¹	
04	200 GeV	0.12 pb ⁻¹	
05	200 GeV	3.4 pb ⁻¹	0.16 pb ⁻¹
06	200 GeV	7.5 pb ⁻¹	2.7 pb ⁻¹
06	62.4 GeV	0.08 pb ⁻¹	0.02 pb ⁻¹
08	200 GeV		5.2 pb ⁻¹

200 GeV d+Au

- Live Time - 89%
- PHENIX up - 77%
- Overall (w/o vertex) - 68%

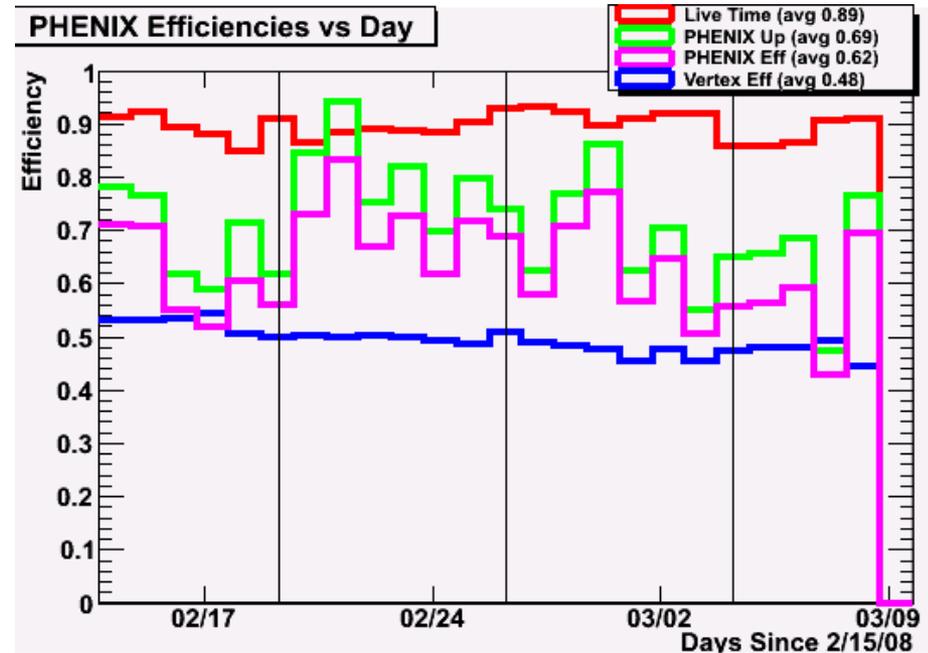
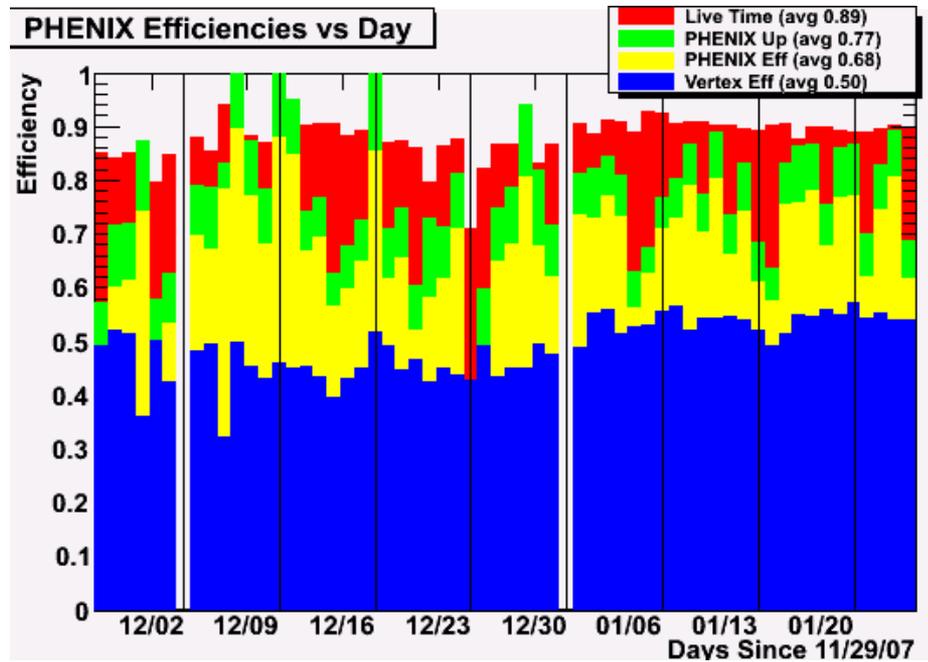
Vertex eff ~50% in both cases!

- will be improved by Stochastic Cooling (SC) & RF advances
- but vertex detector upgrades use ± 10 cm so even with SC can expect only 38% eff!!

Black vertical lines are markers for Maintenance and/or APEX days

200 GeV p+p

- Live Time - 89%
- PHENIX up - 69%
- Overall (w/o vertex) - 62%
(where 10% correction for loss due to CNI measurements is made)



Waste No Rare Triggers - the PHENIX Strategy

Actual trigger setup & rates for one of the hottest Run8 dAu runs

- > 90% livetime
- 85kHz MB (BBC_{VtxCut}) rate

MPC Forward Calorimeter

central-arm γ, π^0, π^\pm , etc

thresh:
2.8 GeV
3.5 GeV
2.1 GeV

$J/\psi \rightarrow e^+e^-$

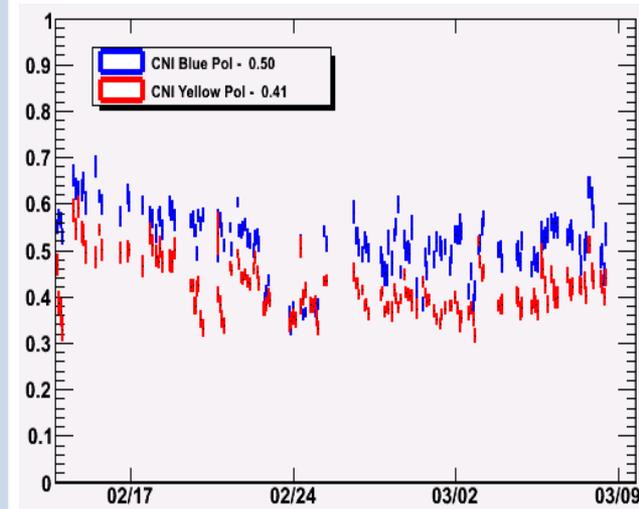
$J/\psi \rightarrow \mu^+\mu^-$

Name	Bit Mask	Scale Down	State	Raw Trigger Rate	Scaled Trigger Rate	Livetime
Clock	0x00000001	999999	Enabled	602604.36	8.63	-0.29
RxNP&BBC	0x00000002	9999999	Enabled	33118.29	0.00	0.92
BBCLL1(>0 tubes)	0x00000004	120	Enabled	85200.89	643.69	0.91
BBCLL1(noVertexCut)	0x00000008	1800	Enabled	154658.48	78.51	0.91
ZDCLL1wide	0x00000010	1000	Enabled	48078.30	44.10	0.92
ZDCLL1narrow	0x00000020	160	Enabled	19016.74	108.44	0.92
MPC_4x4	0x00000040	0	Enabled	90.87	80.79	0.89
MPC_2x2	0x00000080	0	Enabled	86.95	77.64	0.89
ERTLL1_4x4a	0x00000100	1	Enabled	1681.27	751.77	0.89
ERTLL1_4x4b	0x00000200	0	Enabled	175.82	145.79	0.83
ERTLL1_4x4c	0x00000400	9999999	Enabled	7990.56	0.00	0.89
ERTLL1_2x2&BBCLL1	0x00000800	9999999	Enabled	11003.82	0.00	0.92
ERTLL1_4x4a&BBCLL1	0x00001000	0	Enabled	374.23	342.59	0.92
ERTLL1_4x4b&BBCLL1	0x00002000	0	Enabled	143.43	131.17	0.91
ERTLL1_4x4c&BBCLL1	0x00004000	0	Enabled	1092.14	999.25	0.91
ERTLL1_E&BBCLL1	0x00008000	0	Enabled	20.80	477.83	0.92
MUIDLL1_N1D&BBCLL1	0x00010000	2	Enabled	609.28	185.55	0.91
MUIDLL1_S1D&BBCLL1	0x00020000	8	Enabled	3480.49	353.66	0.91
MUIDLL1_N1H&BBCLL1	0x00040000	2	Enabled	692.98	211.43	0.92
MUIDLL1_S1H&BBCLL1	0x00080000	8	Enabled	2376.20	241.81	0.92
MUIDLL1_N2D&BBCLL1	0x00100000	0	Enabled	8.62	7.78	0.90
MUIDLL1_S2D&BBCLL1	0x00200000	0	Enabled	266.15	242.01	0.91
(MUIDLL1_N1D&S1D)&BBCLL1	0x00400000	0	Enabled	38.03	34.48	0.91
MPC_4x4&BBCLL1	0x00800000	0	Enabled	54.97	50.29	0.91
MPC_4x4&BBCLL1(noVertexCut)	0x01000000	0	Enabled	81.16	73.92	0.91

(32 triggers total - some not shown)

Beam & Polarization related Issues

- ❑ Uncertain funding & schedule is inefficient - obviously
 - Is there any way to improve this???
- ❑ Still no 1st look at 500 GeV collisions, a key part of the future pp program!
- ❑ A surprise that 9 Mhz cavity not ready for Run8 - when will it be?
- ❑ Low polarization (50% blue, 41% yellow on 2004 scale!)
 - very little polarization ramp-up/development time
 - PHENIX forced to forgo radial polarization to enable luminosity development (x1/2.3 significance)
 - anti-correlation with luminosity a serious problem!

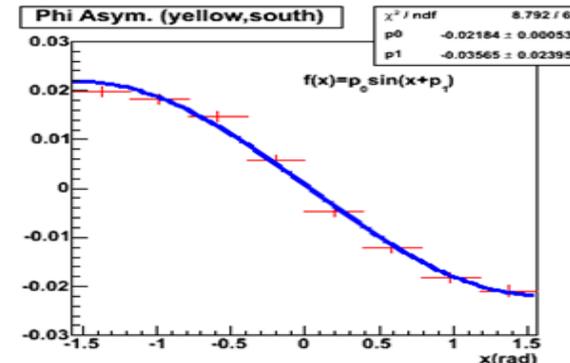
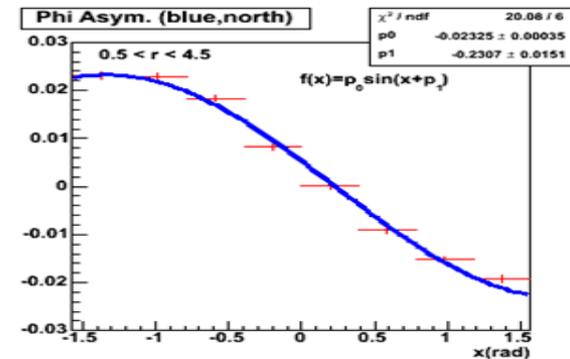
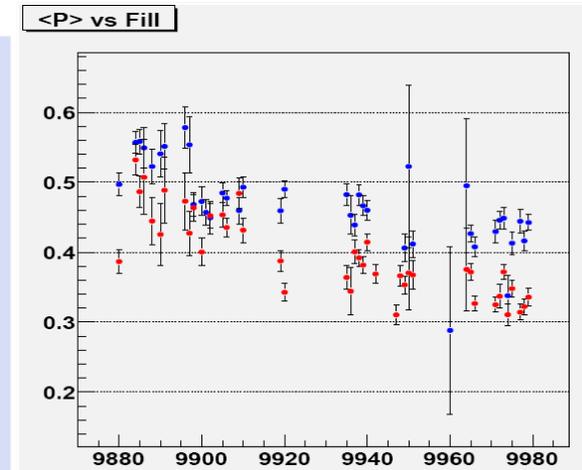


- ❑ Control of backgrounds needs to improve
 - blue was always worse in dAu
- ❑ Auto-orbit corrections every $\frac{1}{2}$ hr affect backgrounds
 - need to be accompanied by auto collimator adjustments that follow orbit movement at collimators
- ❑ Vernier scans
 - need prompt analysis results posted on web
 - better communication with experiments
 - some longer scans to facilitate event analysis at experiments
- ❑ Can the "physics" signal be sent to experiments for consistent luminosity counting?

Beam & Polarization related Issues

□ Faster & more reliable polarization measurements

- Jet measurements were good, but changes between blue & yellow were disruptive
- CNI measurements were not ready until few weeks into run
 - CNI measurements cost significant (~10%) expt uptime due to backgrounds they create (PHENIX turns off)
 - is this counted (by CA) as "physics" luminosity?
 - can measurement time be shorter?
 - can expts take data during measurements?
 - find way to avoid losing CNI targets
 - better (more automatic?) communication with expts
- Local (expt) Polarimeters are important
 - can they be faster & better?
 - results available promptly/automatically on web?
 - PHENIX Local-Pol data limited by main PHENIX DAQ bandwidth
 - Is it worth investment in new detector, FEE or dedicated DAQ in order to get higher accuracy results faster?



Other Issues

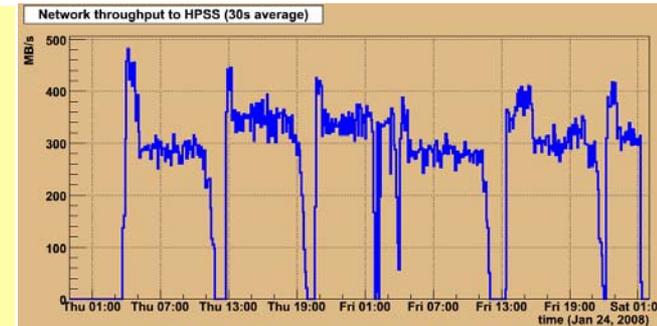
❑ New IRIS scanner is a pain in the neck

- installed w/o warning after beam operations had started
 - keys from MCR were necessary then, and sometimes later
 - why was this not reviewed as to impact & planning?
- many problems during run
 - totally dead - had to get keys from MCR or get expert to reboot it
 - recognizes user but won't release key
 - "violation" error & continuous audible alarm for hours
 - operator GUI at MCR doesn't see key taken



❑ HPSS failures

- PHENIX ok thanks to large local "buffer boxes" and policy to keep data on them until we need the space for new data (takes only 15 min to clean off)
- prompt notification of failures to experiments is important



❑ Heating in PHENIX control room inadequate

- owl shifts on cold nights very cold
- need to replace heater coils before next run

❑ Air conditioning ok except for substation ground-fault caused by NW IR air conditioner

PHENIX Spin Physics Goals - Can we Get there from here?

$A_{LL}(\pi^0)$ goal is 71 pb⁻¹ with 65% polarization

- gluon contribution (ΔG) to the nucleon spin

$$\frac{A_{LL} \text{ goal}}{\text{Run8 } pp} = \frac{71 \text{ pb}^{-1} \times 0.65^4}{5.2 \text{ pb}^{-1} \times 0.5^2 \times 0.41^2} = 58$$

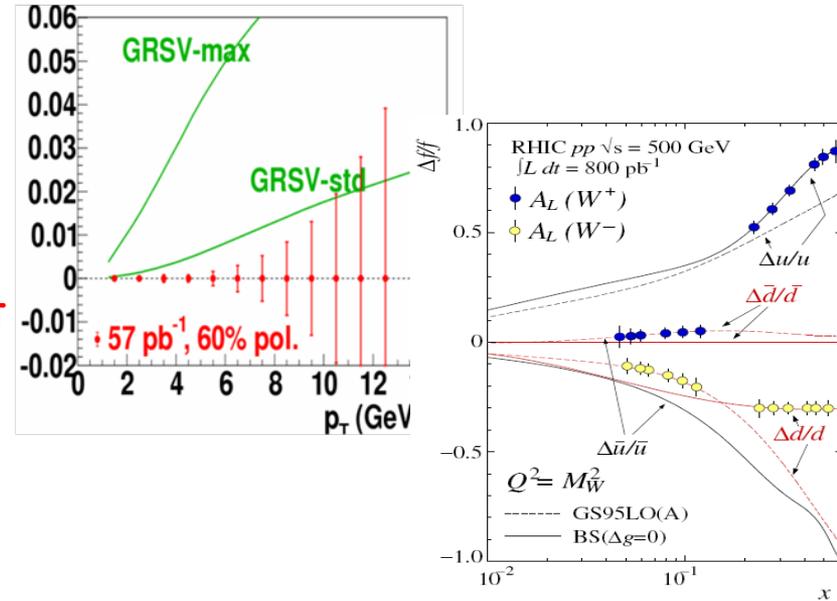
500 GeV W goal is about 300 pb⁻¹ recorded at 70% polarization

- dbar, ubar contribution to the nucleon spin

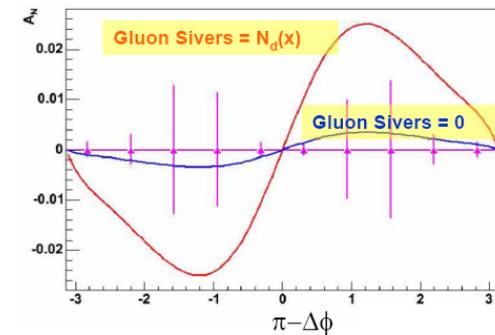
$$\frac{W \text{ goal}}{\text{Run8 } pp} = \frac{300 \text{ pb}^{-1} \times 0.70^2}{5.2 \text{ pb}^{-1} \times 2.5 \times 0.5 \times 0.41} = 55$$

Radial Polarization goal was 7.5-10 pb⁻¹ at 60% polariz.

- Sivers - $(7.5 \times 0.60^2) / (5.2 / 2.3 \times 0.5 \times 0.41) = 5.8$ short of goal
 - factor of 2.3 due to not having Radial polarization
- Mono-jets - pp is baseline for dAu
 - MPC on both sides (unlike STAR) is a plus



Boer and Vogelsang, hep-ph/0312320

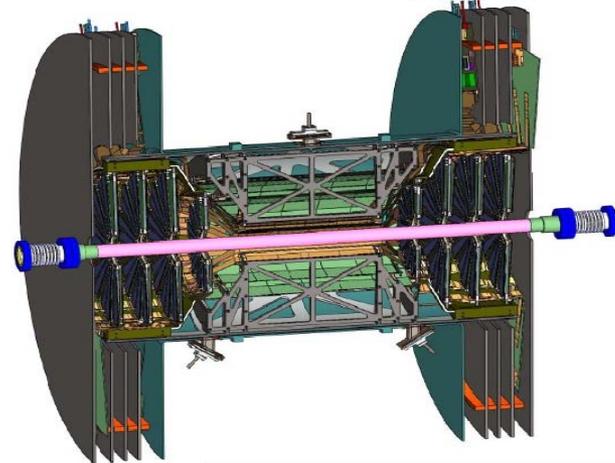
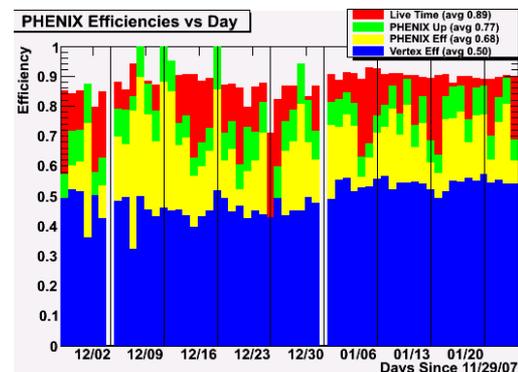
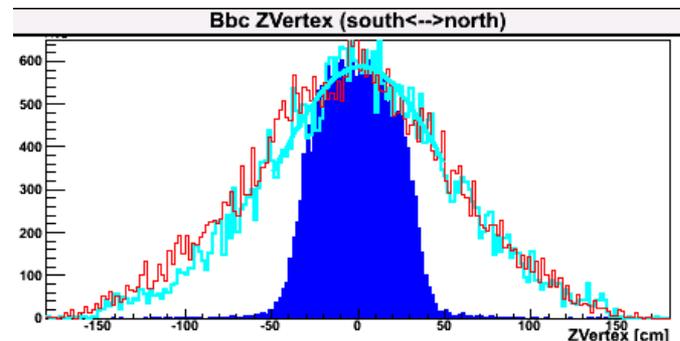


Run9 - Likely need p+p 1st - can't live another year without a STRONG pp run with ample development towards higher FOM!

The Persistent Problem of Interaction Diamond Sizes

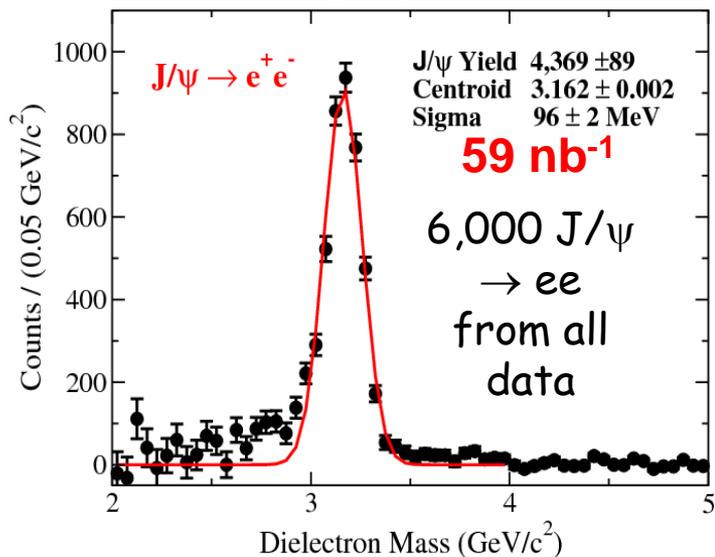
With present interaction diamond z-size PHENIX gets about a factor of two loss in luminosity with our ± 30 cm vertex cut (see earlier slide)

- with Stochastic Cooling (longitudinal) and full voltage 200 Mhz RF it is thought that the vertex can be narrowed to ± 20 cm for AuAu collisions
- super Beta quads could help
- for pp collisions 9 Mhz cavity will help?
- but the Vertex detector upgrades require ± 10 cm cuts, which even for ± 20 cm distributions, will give only a 38% efficiency!
- I guess STAR will have similar issues
- also some loss? (~20%) for beam in non-central buckets - 56 Mhz cavity (2012) should help with this

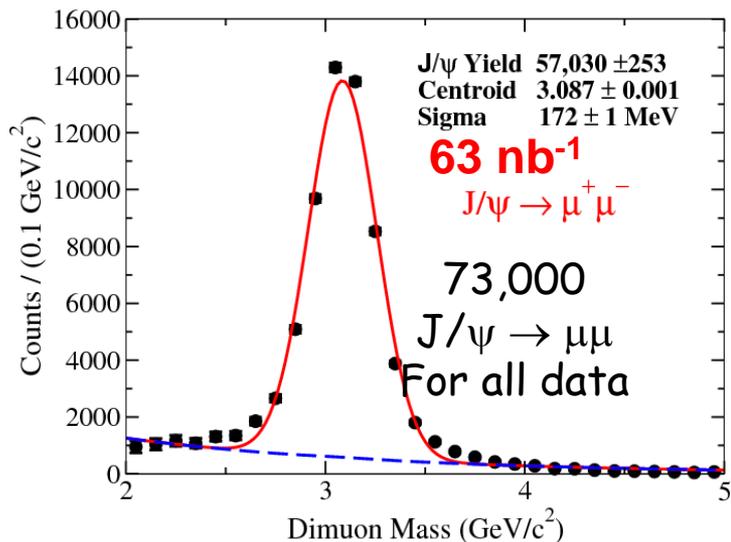
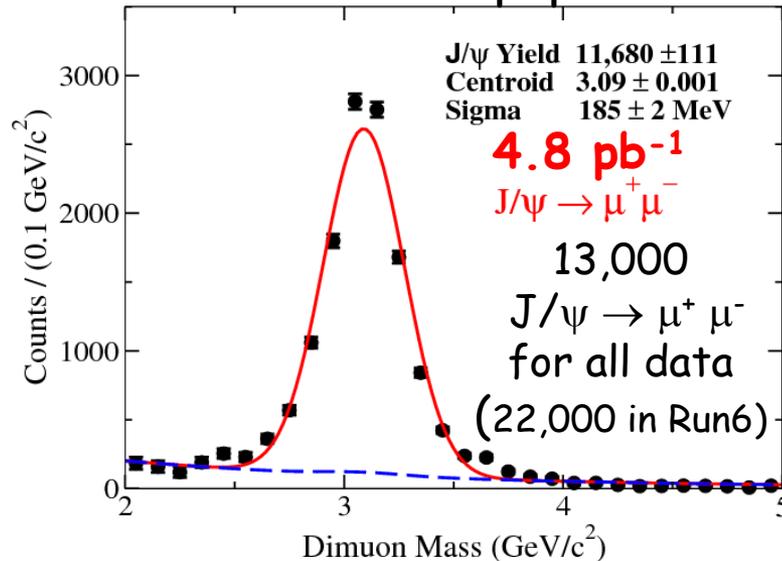


PHENIX J/ ψ 's from Run8

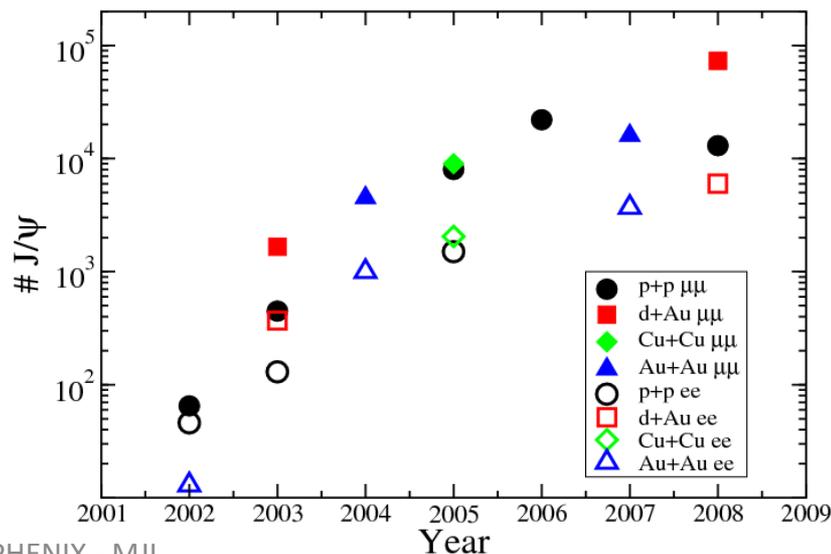
200 GeV d+Au



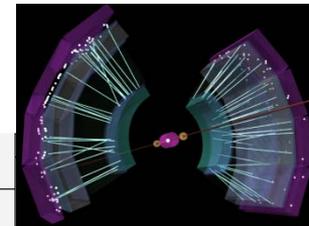
200 GeV p+p



PHENIX - Approx. #'s J/ ψ vs Year

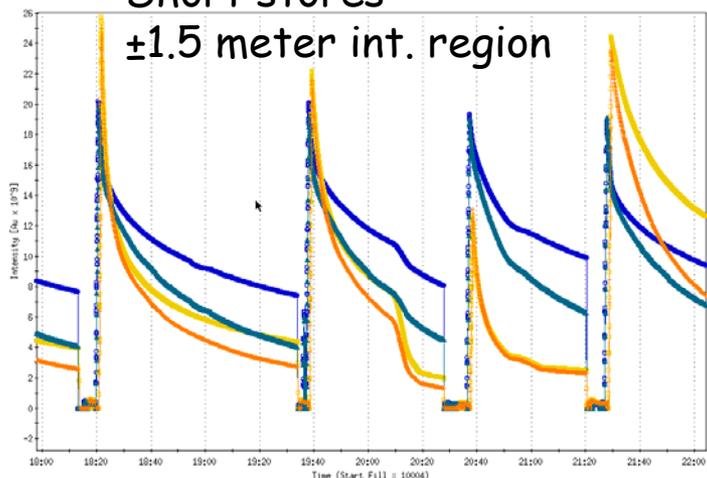


9.2 GeV 2-day test Run



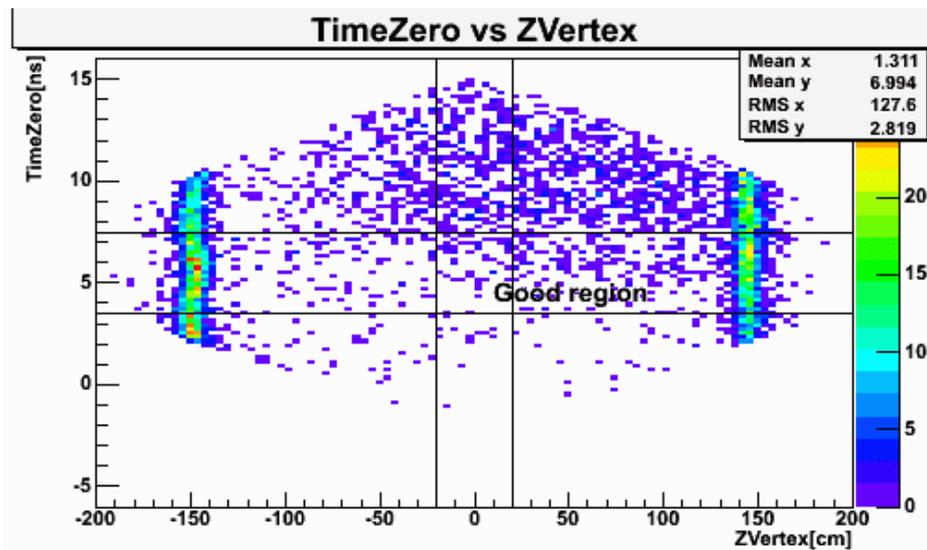
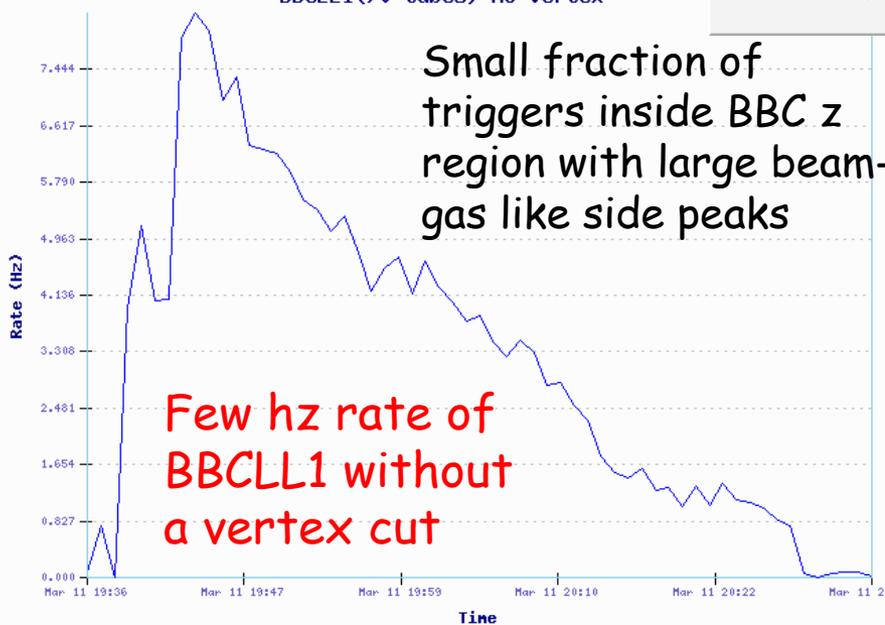
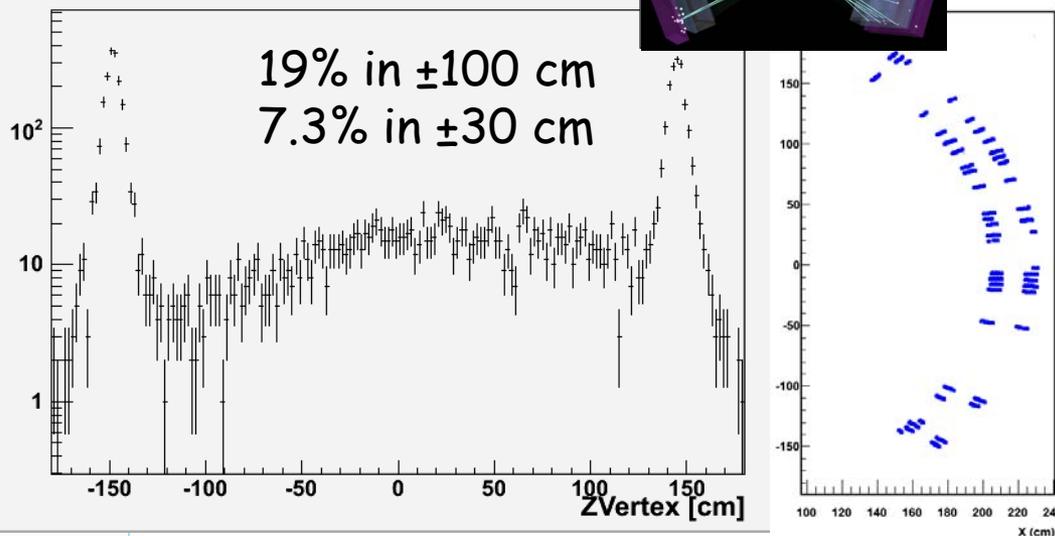
Short stores

± 1.5 meter int. region



BBCLL1(>0 tubes) no vertex

BBC ZVertex triggered by BBLL1(noVtxCut)



Backup Slide(s)

The Optimistic Scenario for Spin Physics Goals

- Major Spin Physics Goals
 - $A_{LL}(\pi^0)$ @ 200 GeV - 71 pb⁻¹ at 65% polarization
 - W @ 500 GeV - 300 pb⁻¹ at 70% polarization
 - assume $L_{500\text{GeV}}/L_{200\text{GeV}} = 2.5$
- assume luminosity recorded/delivered = 1/3
- Luminosity & polarizaton from CA planning document

Expected advances:

- 9 Mhz RF cavity
- LEBT/MEBT (transfer line) improvements
- Triplet 10hz reduction
- Electron lens
- 56 Mhz RF
- Polarized source upgrade

Scenario	Lumi/wk (delivered)	Polariz	#weeks to reach goal	
			A_{LL}	W
Run6 Achieved	7 pb ⁻¹	60%	42 wks	70 wks
Run9 Projected	14 pb ⁻¹	65%	15 wks	30 wks
2013E max Projected	39.8 pb ⁻¹	75%		8 wks