

PHENIX RUN-10 REPORT

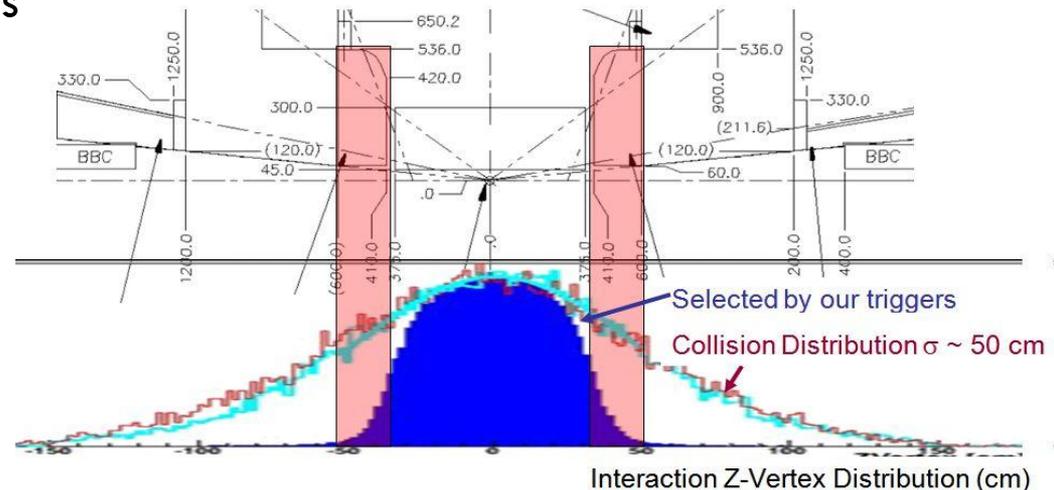
Detector Operations in Run 10

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- Maximize uptime
 - Run Coordinator leading tiered management
 - 5 person shift crews, bi-weekly Period Coordinators, on-call DAQ & detector experts; daily shift-change meetings
 - Statistics logged at many places (scalers, network speeds, etc.) and monitored
 - Excellent communication with CAD (and STAR)

Lvl1 selection on longitudinal vertex optimizes events for offline analysis

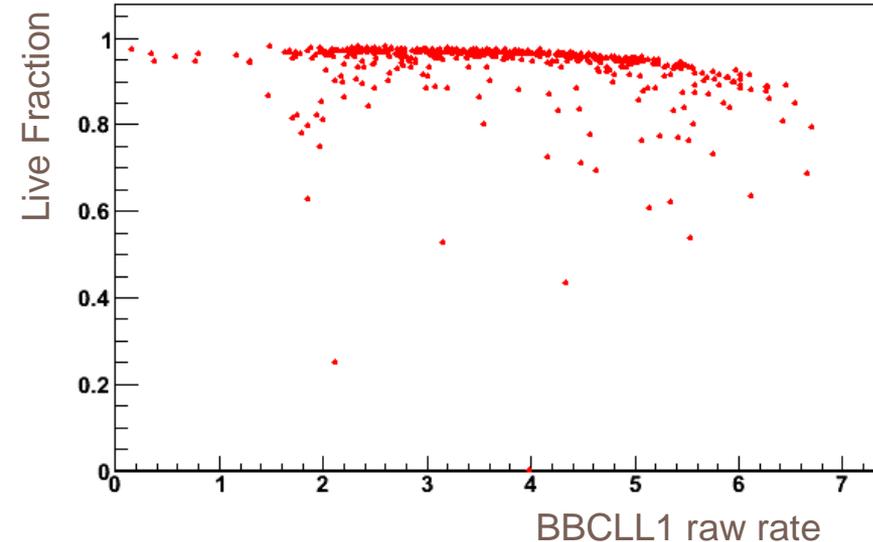
Normally $\sim 50\%$ inside ± 30 cm,



Operational changes for Run-10

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Run 10 200 GeV Au+Au PHENIX DAQ Livetime



DAQ livetime > 95 % at up to 5.5 kHz raw event rate

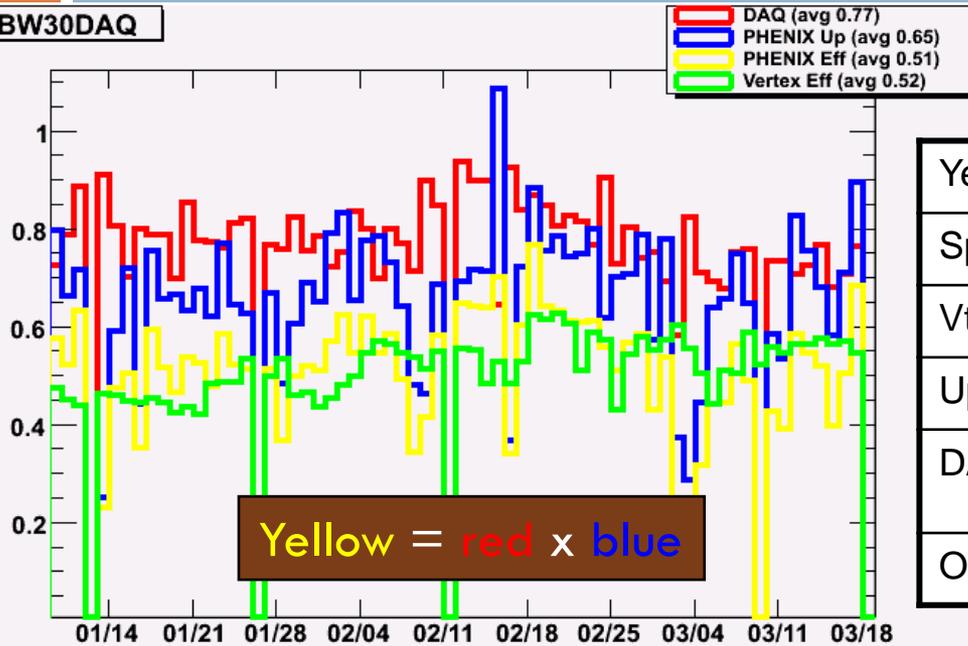
- DAQ livetime 90 → 95% up to 5.5 kHz
- Prescale configurations make optimal use of livetime
- Introduced different vertex cuts at trigger level 1
 - ▣ Key for future running with VTX + muon arms
 - ▣ Allowed to maximize *useful* events in HBD
- CAD's new LLRF removed need to switch between RHIC and internal clock during filling. →
 - ▣ 10 min fills at low \sqrt{s} , end of "clock glitches" & DAQ element re-synch
 - ▣ will increase uptime from Run-11 onward

Definitions for Evaluating Efficiency

- *Vertex acceptance*
 - ▣ Luminosity inside +/- 30 cm longitudinally (~50% of luminosity)
- *PHENIX Uptime*
 - ▣ Fraction of delivered “cogged/steered/collimated—i.e. physics ” luminosity within vertex acceptance when PHENIX detector and DAQ are taking **good** data
 - ▣ Contributing factors: integration/set-up work, problems, HV ramp, clock switch, non-physics data (calibrations, field-off or problem runs)
- *Livetime*
 - ▣ DAQ is not busy - ready for events (traditional definition)
 - ▣ matters in p+p where all physics comes from level 1 trigger sampling
- *DAQ efficiency*
 - ▣ Fraction of delivered luminosity within vertex acceptance and during PHENIX uptime that is sampled by the PHENIX Level-1 triggers
 - ▣ includes livetime and trigger prescale factors
 - ▣ matters in Au+Au where physics is foremost in minimum bias events that is limited by DAQ bandwidth
- *PHENIX efficiency = DAQ efficiency x Uptime*
- *Overall efficiency = PHENIX efficiency x Vertex acceptance*

Efficiency at 200 GeV

hBW30DAQ



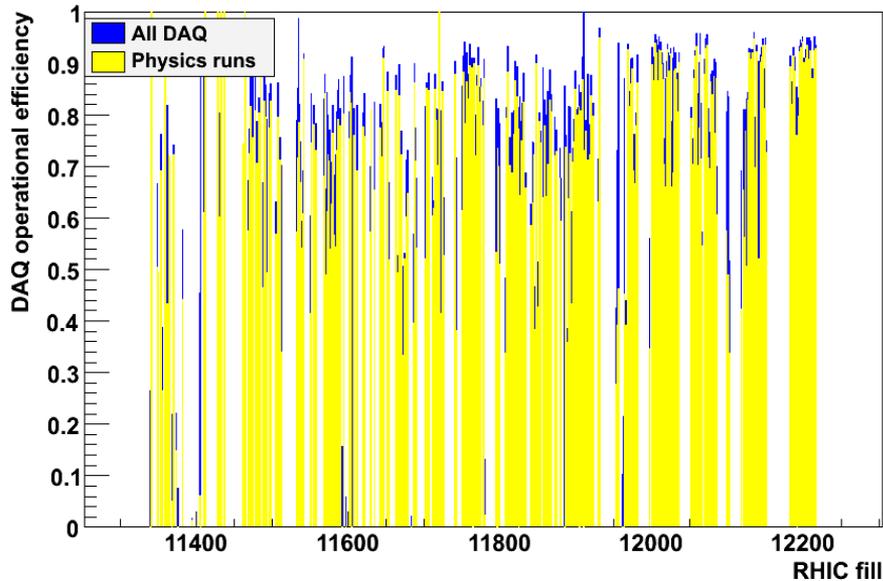
Year	2007	2010
Species	Au+Au	Au+Au
Vtx accept.	~50%	51 %
Uptime	64%	66 %
DAQ effi.	82%	76 % (84 % (± 20 cm); 83% (lv1))
Overall	26%	26 %

- Similar overall efficiency as in Run-7
- **But**
 - Recorded 50 % larger data set in 75 % of the time
 - Factor two better performance (RHIC x PHENIX)
 - Almost able to keep up with RHIC's luminosity increase
 - Ran rare triggers for the first time in Au+Au
 - Prepared for future high luminosity

Efficiency at other energies

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Fraction of physics fills with PHENIX DAQ running

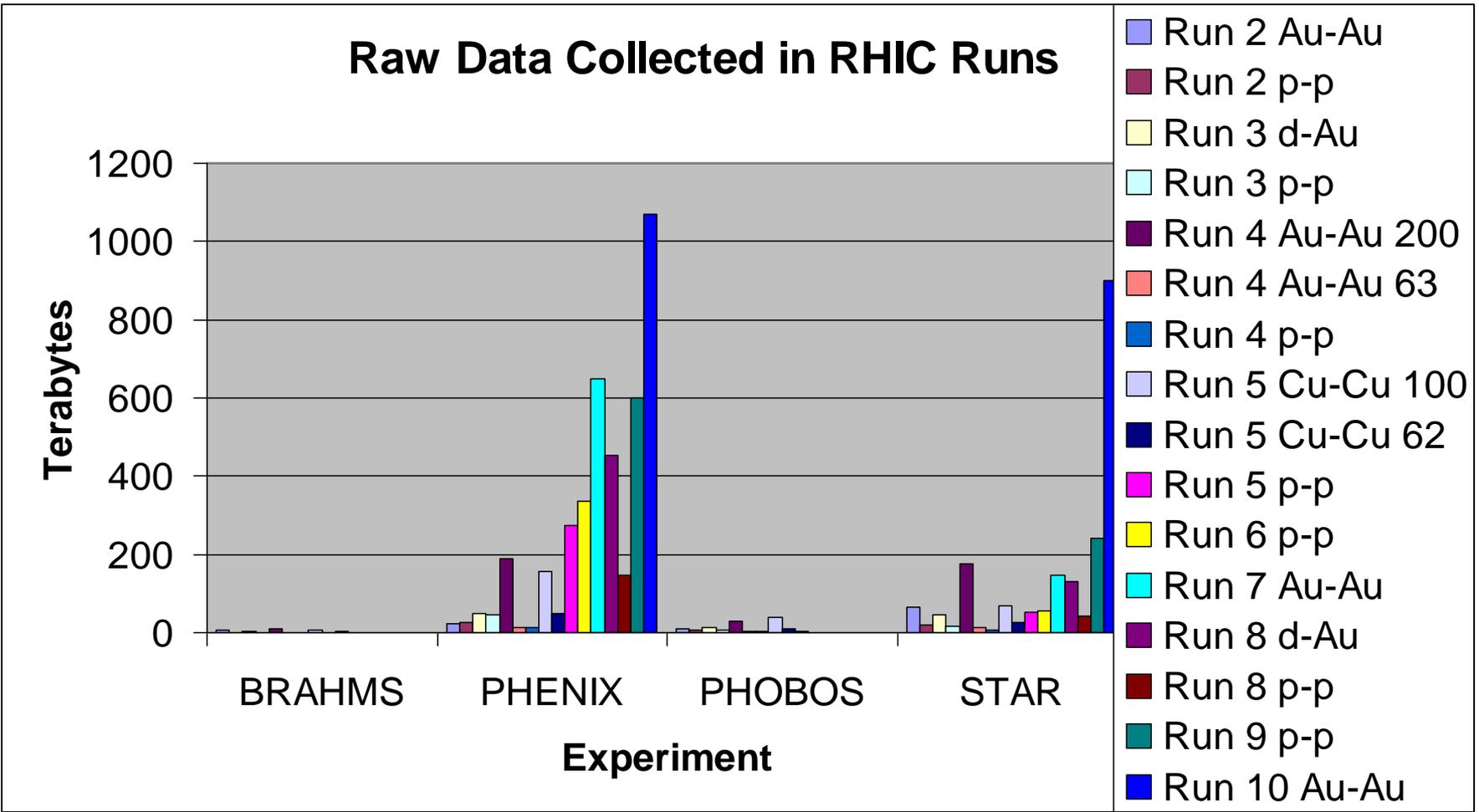


Increase of uptime with time into Run-10 / decreasing beam energy

	200 GeV	62 GeV	39 GeV
N_{fills}	256	89	60
$\langle \text{uptime} _{\text{running}} \rangle$	0.73	0.81	0.84
$\langle \text{uptime} _{\text{good runs}} \rangle$	0.64	0.69	0.78

Uptime very high for 7.7 GeV running (no HV ramping or clock changing)

Milestone! PHENIX data rate > 1 PB/year



A world-wide first!

Superb RHIC performance → lots of data

Run	Year	Species	$\sqrt{s_{NN}}$ (GeV)	$f L dt$	N_{Tot}	p+p Equivalent	Data Size
10	2010	Au+Au	200	1.3 nb ⁻¹	8.2G	54 pb ⁻¹	885 TB
		Au+Au	62.4	0.11 nb ⁻¹	700M	4.5 pb ⁻¹	76 TB
		Au+Au	39	40 μb ⁻¹	250M	1.6 pb ⁻¹	34 TB
		Au+Au	7.7	0.26 μb ⁻¹	1.6M	11 nb ⁻¹	6 TB

- Original goals were

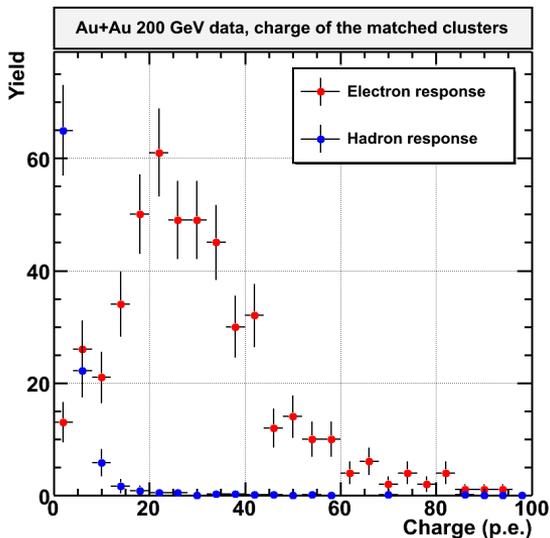
- Low mass e⁺e⁻ at 200 and 62 GeV
- light quark R_{AA} at 39 GeV

- Larger than expected data sets → additional observables

- J/ψ suppression at 62.4 GeV to test recombination
- low mass e⁺e⁻ excess; π/K/p flow at 39 GeV
- hadron yields, ratios, spectra, fluctuations & correlations at 7.7 GeV
- Muon trigger detector commissioning during 11.5 GeV run

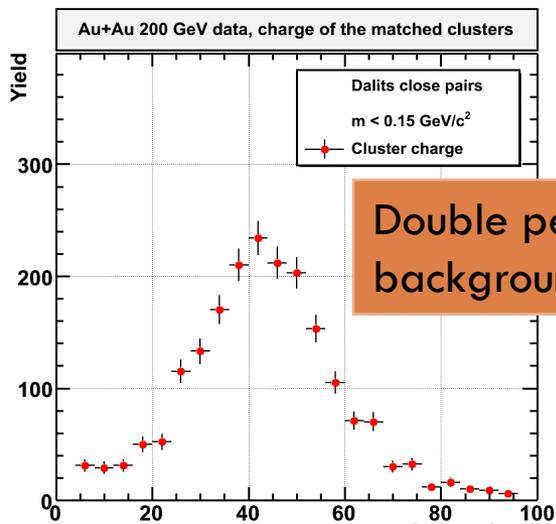
HBD Performance in 200 GeV Au+Au

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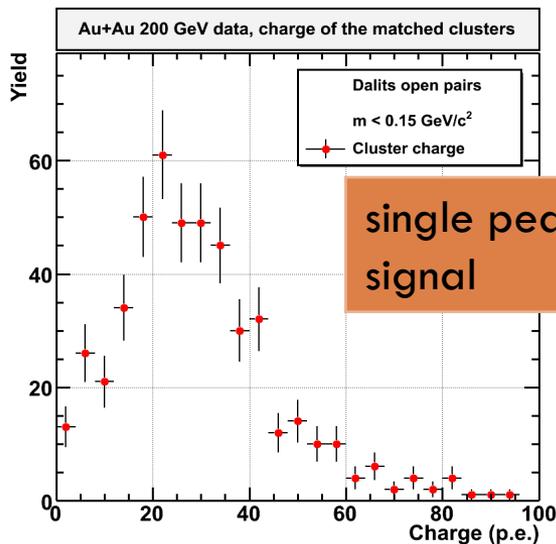


Hadron rejection

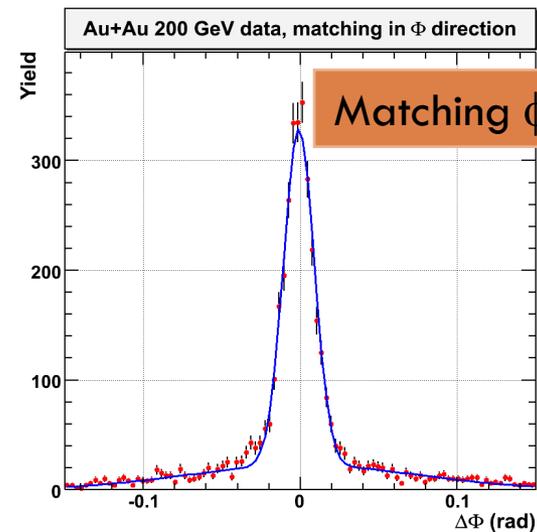
HBD worked
as expected



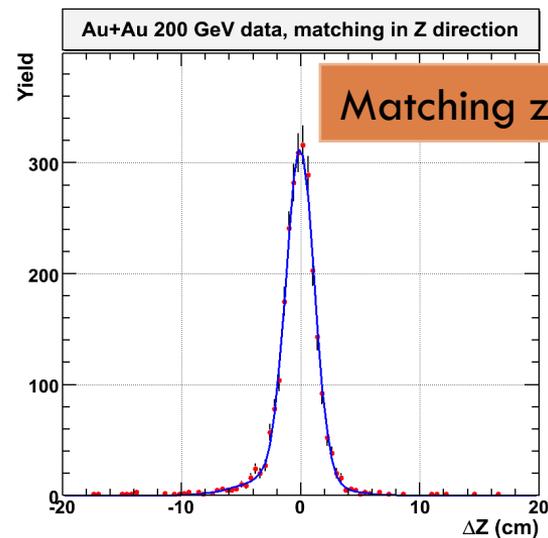
Double peak:
background



single peak:
signal



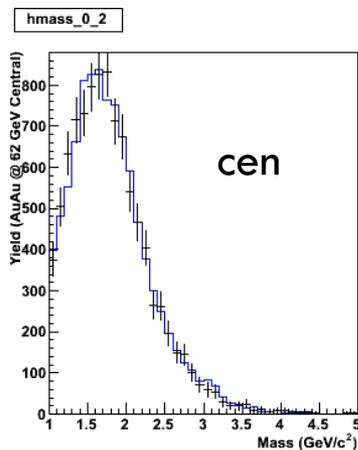
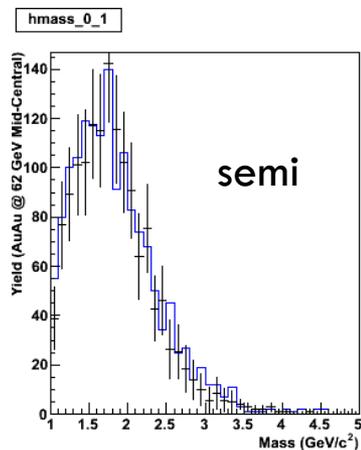
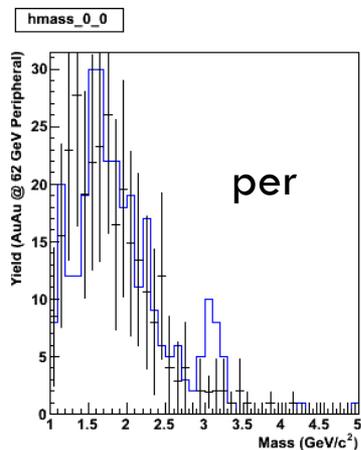
Matching Φ



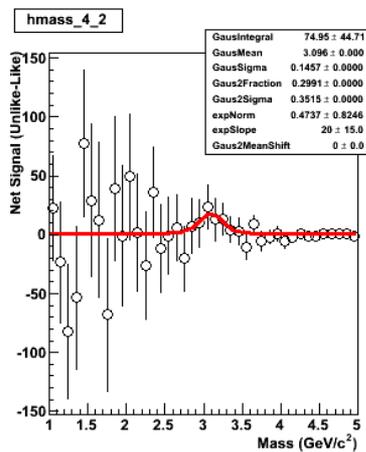
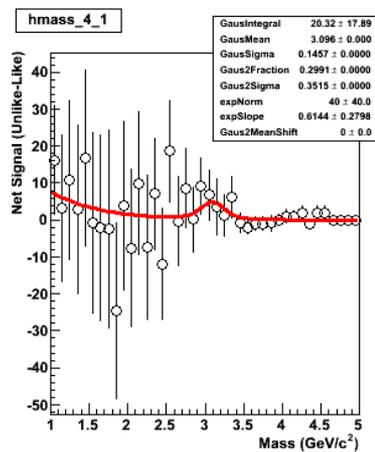
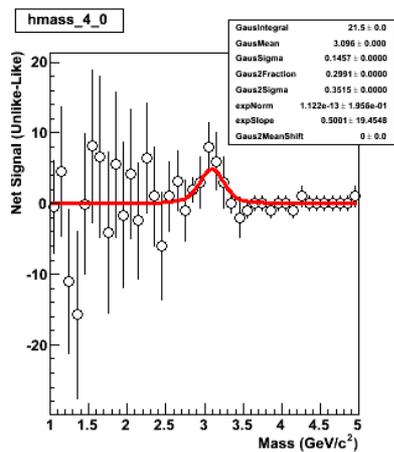
Matching z

First Glimpse at J/ψ from 62 GeV

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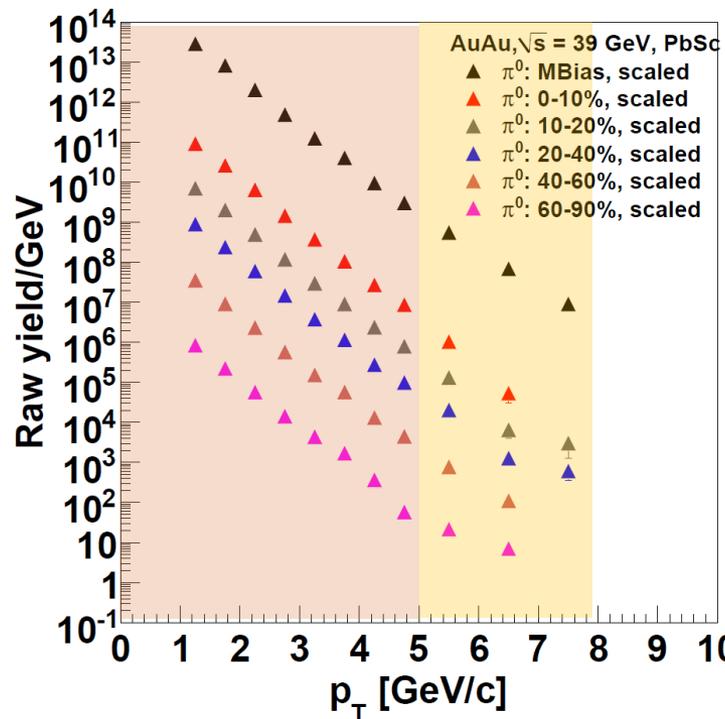
Peak visible from about 25 % of statistics



Encouraging!

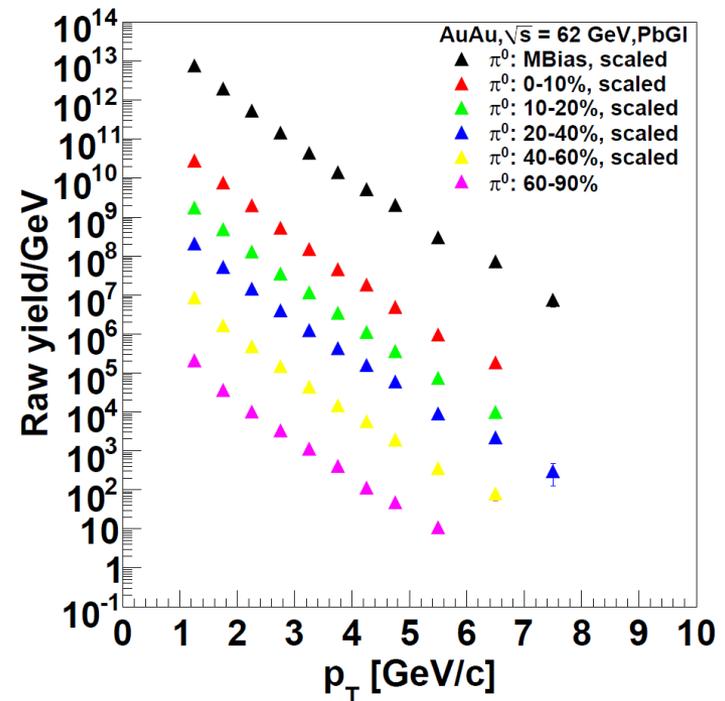
π^0 yields (uncorrected) at 39 GeV

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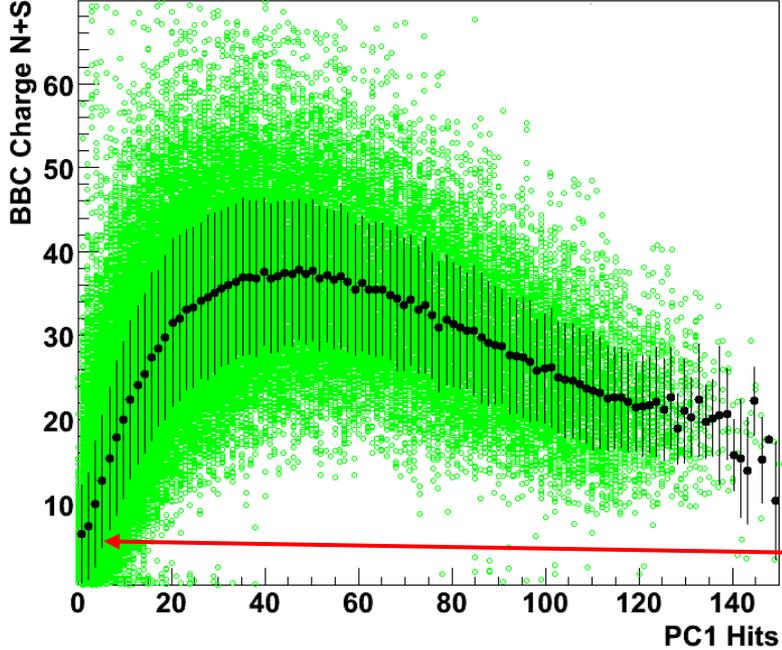
desired p_T reach

Extra p_T reach



Particle production and fragmentation at 7.7 GeV

forward



90 degrees

Run-10 AuAu @ 7.7 GeV

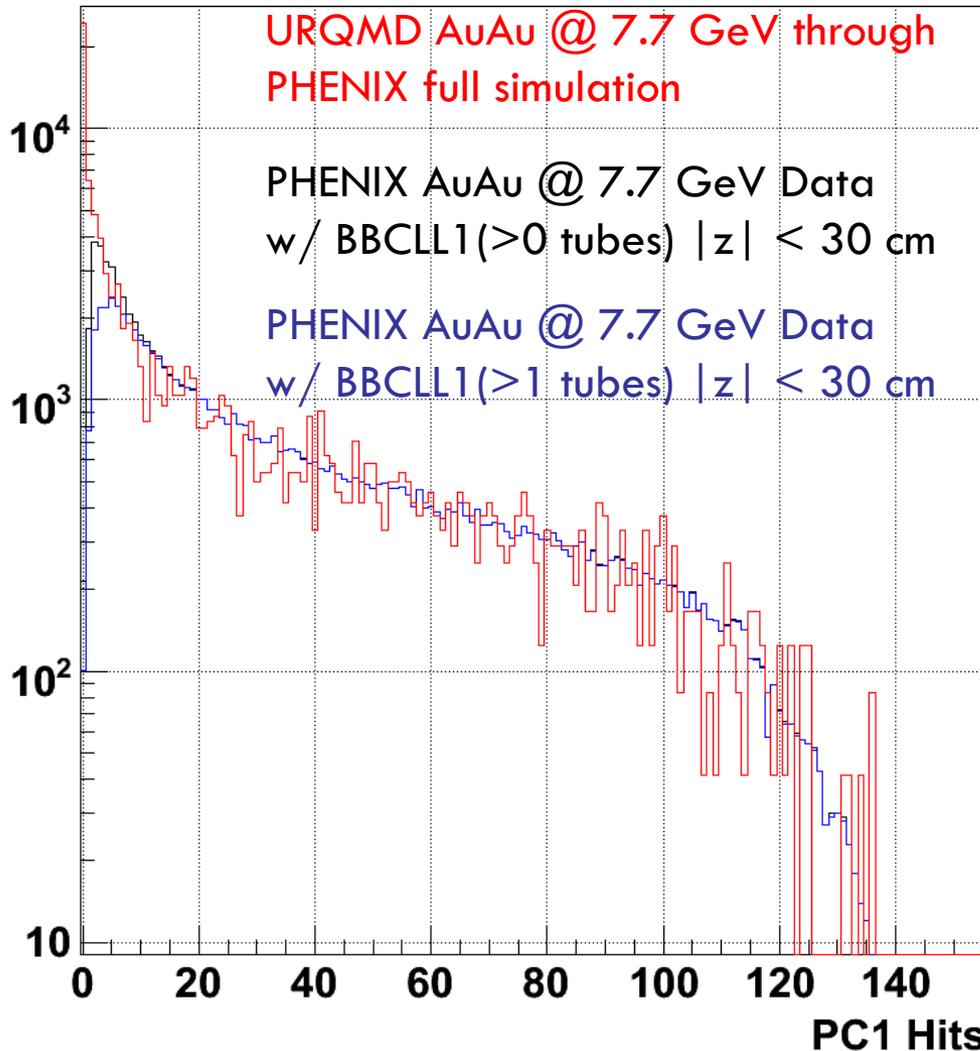
72,078 events total up to Run Number 315,999 passing BBCLL1(>1 tubes) and $|z| < 30$ cm.

Is there hidden background?

Very similar to what was seen at 9 GeV and expected from URQMD + fragmentation model

Background check: negative

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URQMD normalized to match real data integral for PC1 hits > 40 .

URQMD not matched to z distribution in real data. **However, note that there is no rescaling of the x-axis.**

Then comparing the integrals implies (as a first look) that the BBCLL1(>0 tubes) fires on 77% of the cross section and the BBCLL1(> 1 tubes) fires on 70% of the cross section.

No indication of deviation at low PC1 hits from background (at least by this particular check).

2010 Shutdown

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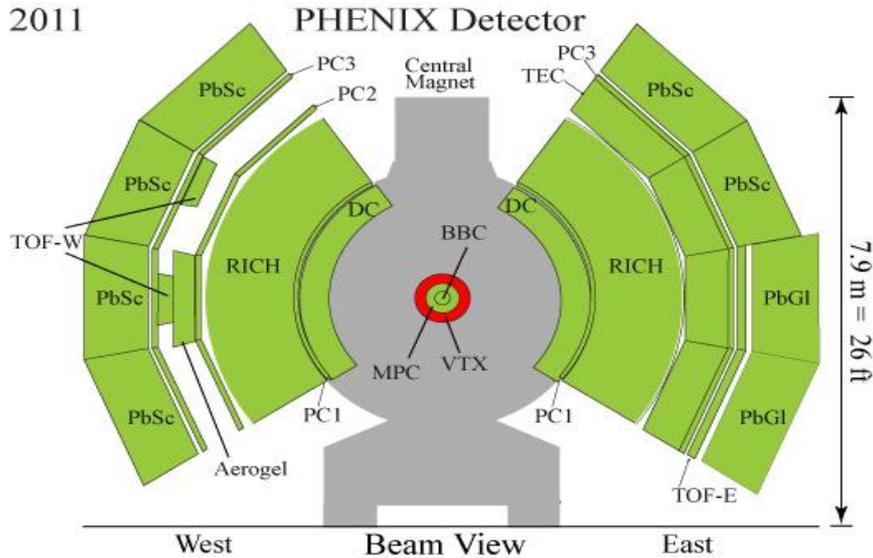
- New Beam pipe
- VTX installation
- MuTrg St3 S installation
- Stainless steel Absorber installation
- EvB/DCM II Upgrade
- General Maintenance (DC, MuTracker, EMCAL...)

Very busy 2010 shutdown

Run-1 1

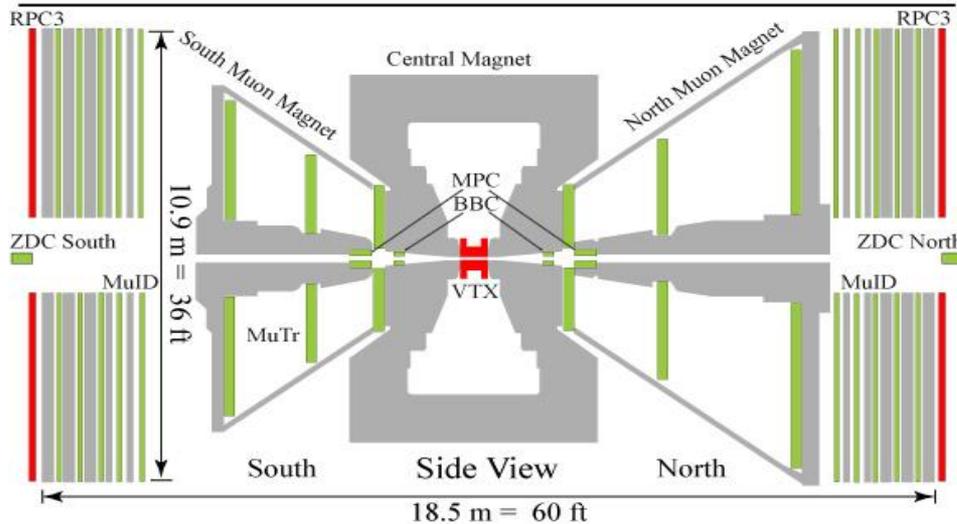
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2011



VTX Replaces HBD
 Muon Trigger:
 μ Tr FEE
 RPC station 3

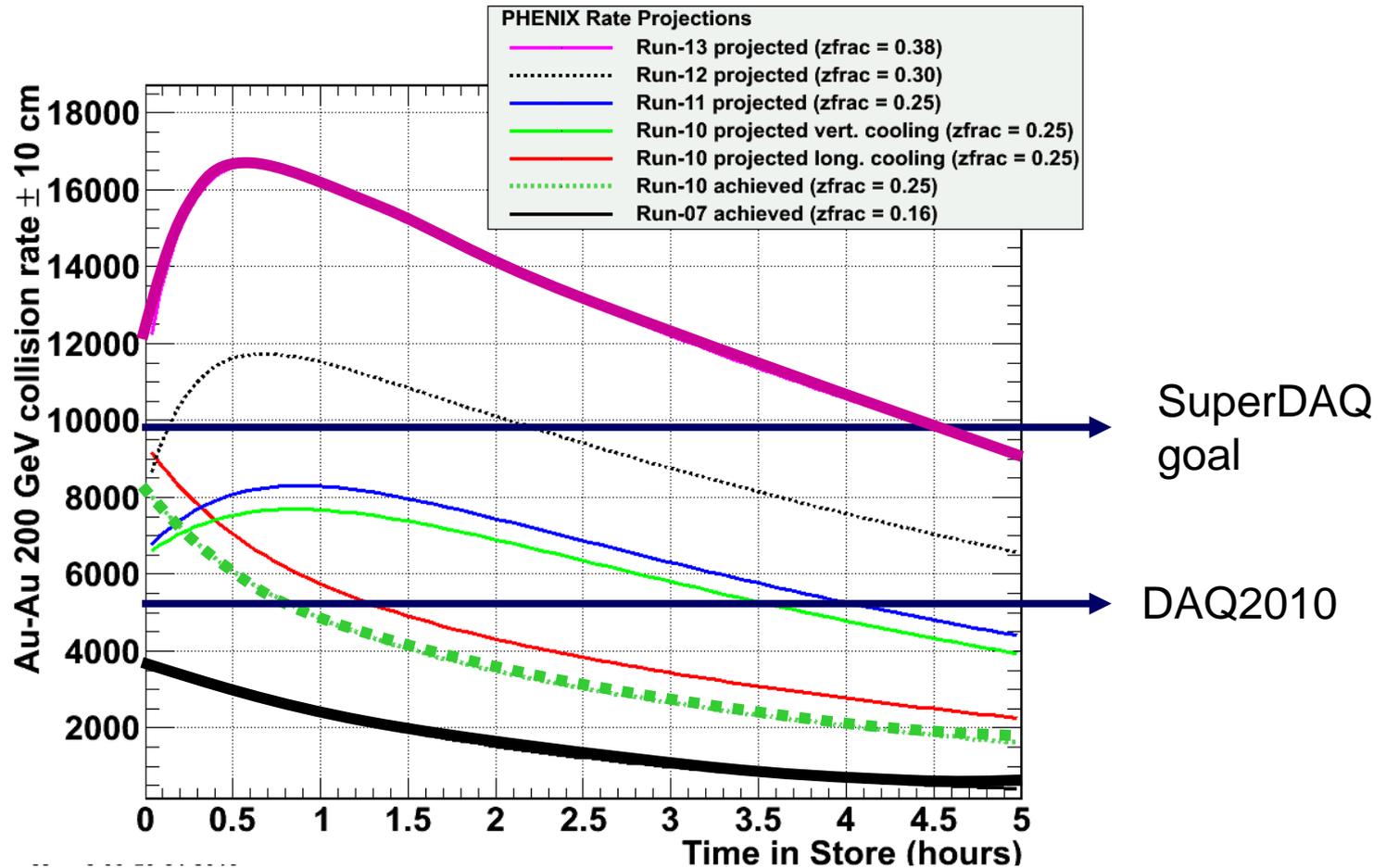
Need 500 GeV p+p running first for vtx commissioning



- 500 GeV p+p for MuTrg (W measurement)
- 200 GeV Au+Au for VTX
- Short U+U run with EBIS
- Either Au+Au energy scan continued (27, 18 GeV) or p+p energy scan comparison data

RHIC-II Projections

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RHIC II luminosity and *new proposed DAQ upgrades* can sample **50 billion** AuAu events (in 10 week run in Run-13), including recording ~25 billion minimum bias events (i.e. no trigger bias).

Summary

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□ Run-10

- Numerous operational changes that increased efficiency in Run-10 and prepare for future high-luminosity running
- Recorded our largest full energy Au+Au data set: 8.2 G events, 1.3 nb^{-1}
- Exceeded our goal in energy scan by factor 2-3 for 62.4, 39 and 7.7 GeV
- Working HBD for the whole run
- Recorded 1 PByte of data for the first time

□ Shutdown

- Vtx/MuTrigger/Absorber installation

□ Run-11

- 500 GeV polarized p+p W physics
- 200 GeV Au+Au vtx physics
- Energy scan between SPS and full RHIC energy

Need first for vtx commissioning

