

Λ and $\bar{\Lambda}$ Production In Au+Au Collisions at RHIC

PHENIX

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For ...

the PHENIX Collaboration



Motivation

Strangeness production and antihyperon to antibaryon ratios are important probes for the high-energy-density nuclear matter created in ultra-relativistic heavy ion collisions.

Current Important Questions:

- Strange Particle Production Cross Section ?
- Strangeness Enhancement ?
- Flavor Composition of Nuclear Matter at High Energy Density ?
- Baryon Transport Mechanism ?
- Strange Particle Correlations/Flow ?

Useful Applications

- Feed-down correction for protons and anti-protons

PHENIX Measurements $\sqrt{s_{NN}} = 200$ GeV **Work in progress**

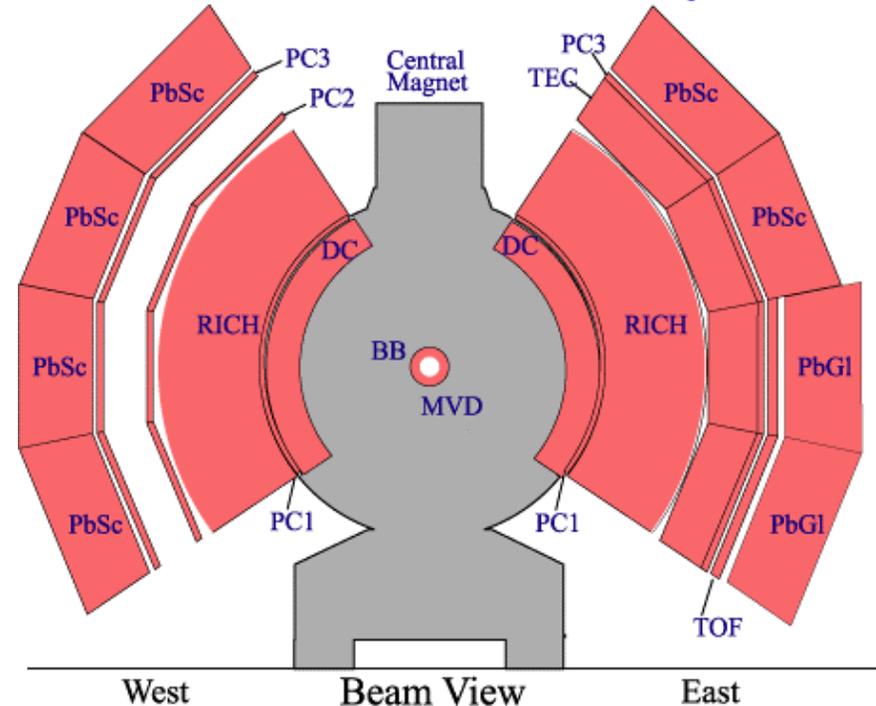
$\sqrt{s_{NN}} = 130$ GeV **Phys.Rev.Lett. 89 (2002) 092302**

Analysis Procedure

Tracking performed with:

- Drift Chamber (DC)
 - PadChamber (PC1 & PC3)
 - Electromagnetic Calorimeter (EMCal)
- Centrality Selections made via the correlation between the analog response of Zero Degree Calorimeter (ZDC) and the Beam Beam Counter (BBC)
 - Particle Identification (PID) EMC and TOF

PHENIX Detector - Second Year Physics Run

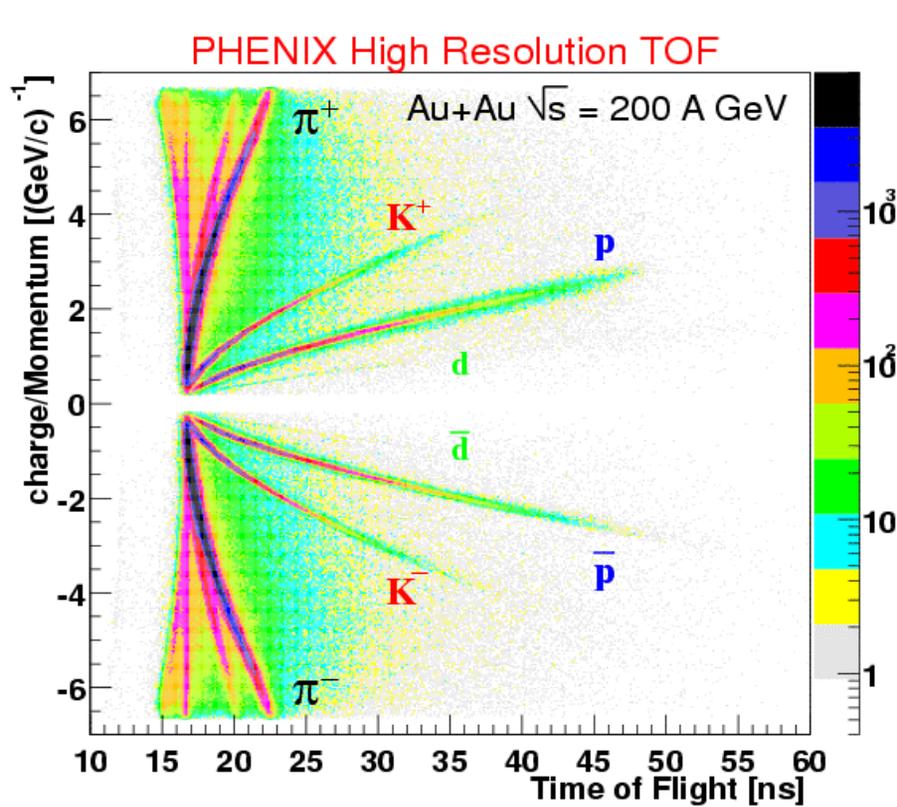


$$\sigma_p/p \sim 0.6\% \oplus 3.6\% p \quad (130 \text{ GeV})$$

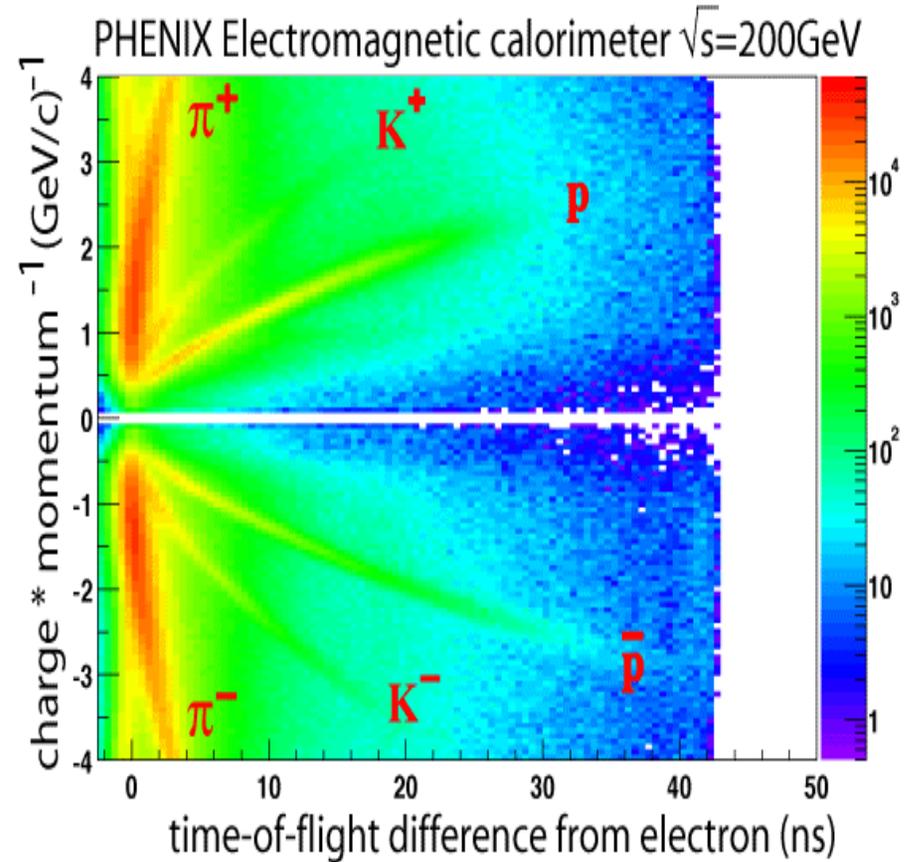
Momentum resolution:

$$\sigma_p/p \sim 1\% \oplus 1\% p \quad (200 \text{ GeV})$$

Particle Identification in Phenix



TOF timing resolution ~120ps



EMC timing resolution:

~700 ps (130 GeV)

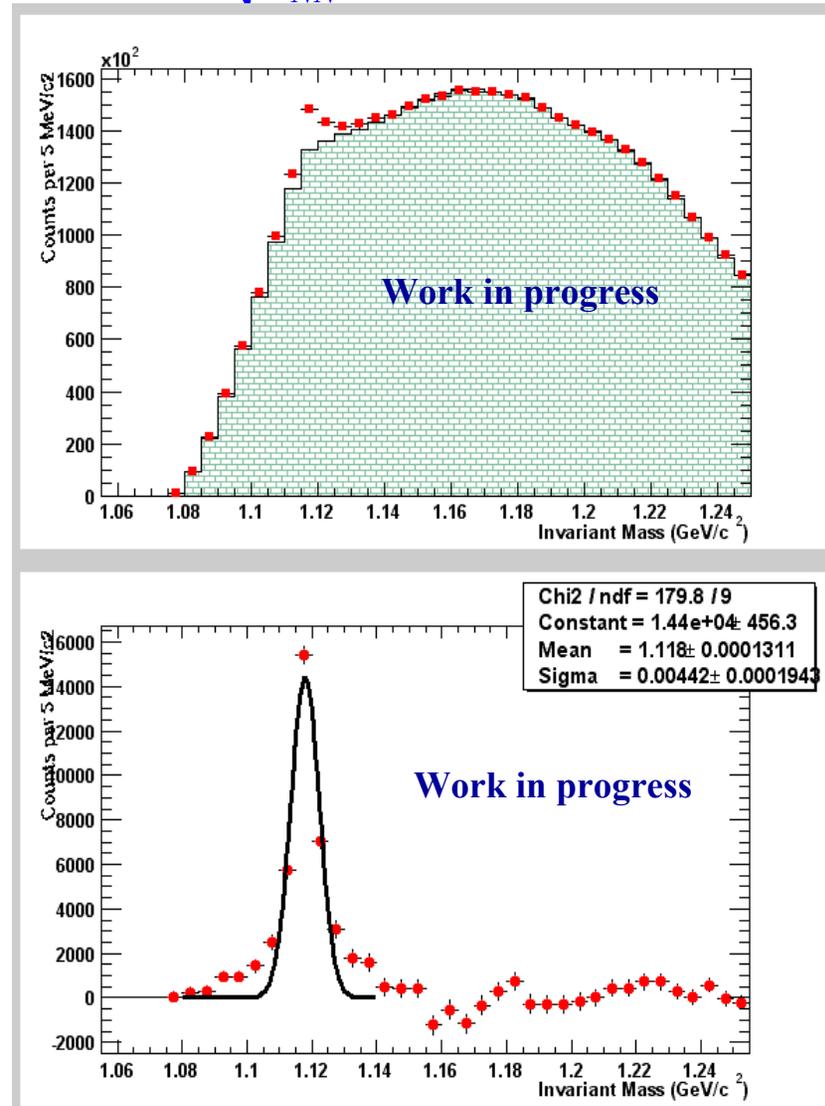
~450 ps (200 GeV)

Analysis Procedure

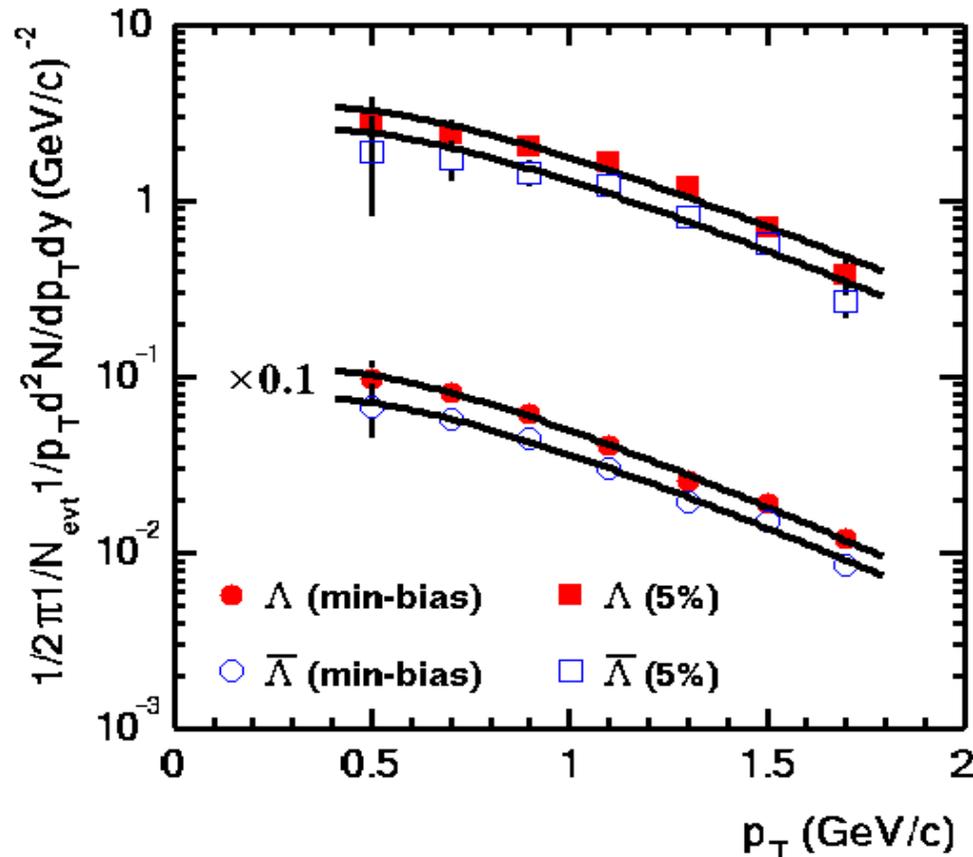


- Invariant mass distribution constructed for daughter particle pairs
- Combinatorial background estimated from mixed events
(from the same centrality, vertex event class)
- Primary vertex used to construct the Momentum of daughter particles

$$\sqrt{s_{NN}} = 200 \text{ GeV}$$



Au+Au at 130 GeV



Corrections made for:

- Acceptance,
- In-flight-decay of pions
- Momentum resolution
- Reconstruction efficiency

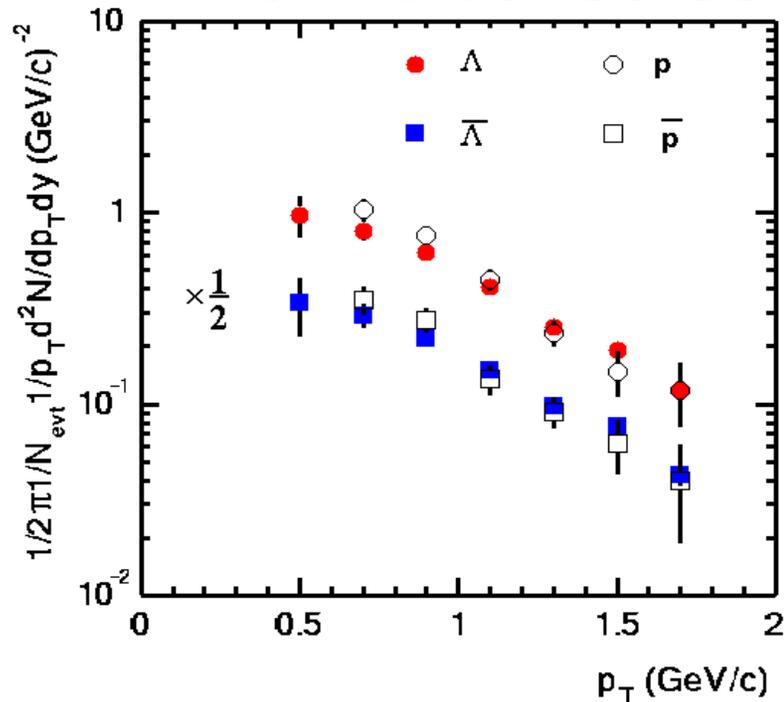
The yield is obtained by integrating the functional fit

$$\frac{dN}{dp_T^2} \propto p_T e^{-p_T/T}$$

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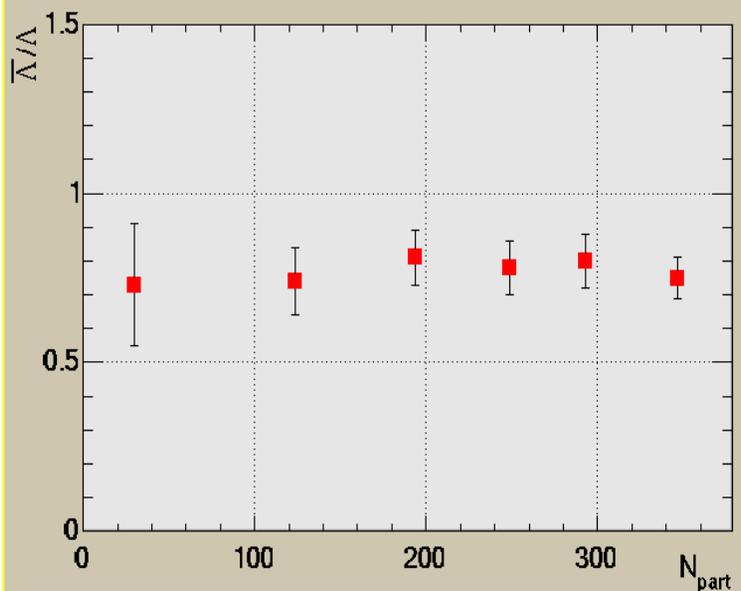
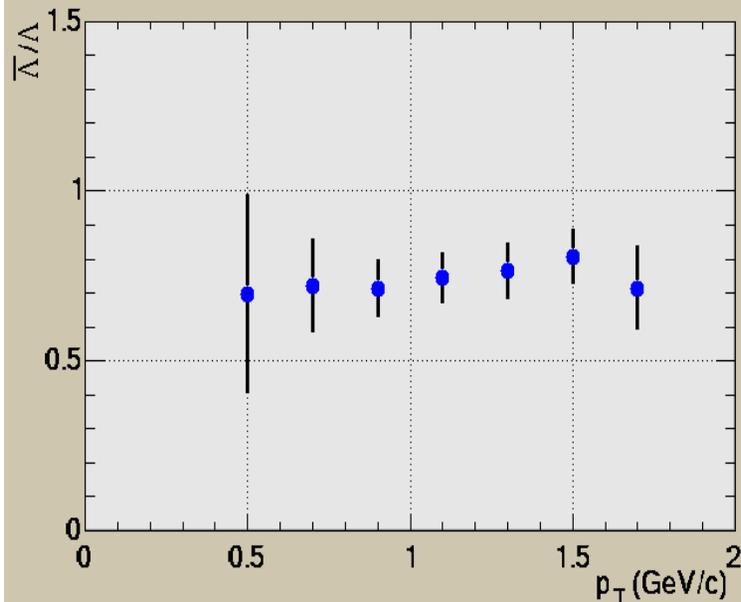
spectra include both primary and feed-down contributions

Au+Au at 130 GeV



Spectra of inclusive and feed-down corrected protons (antiprotons) for minimum bias events.

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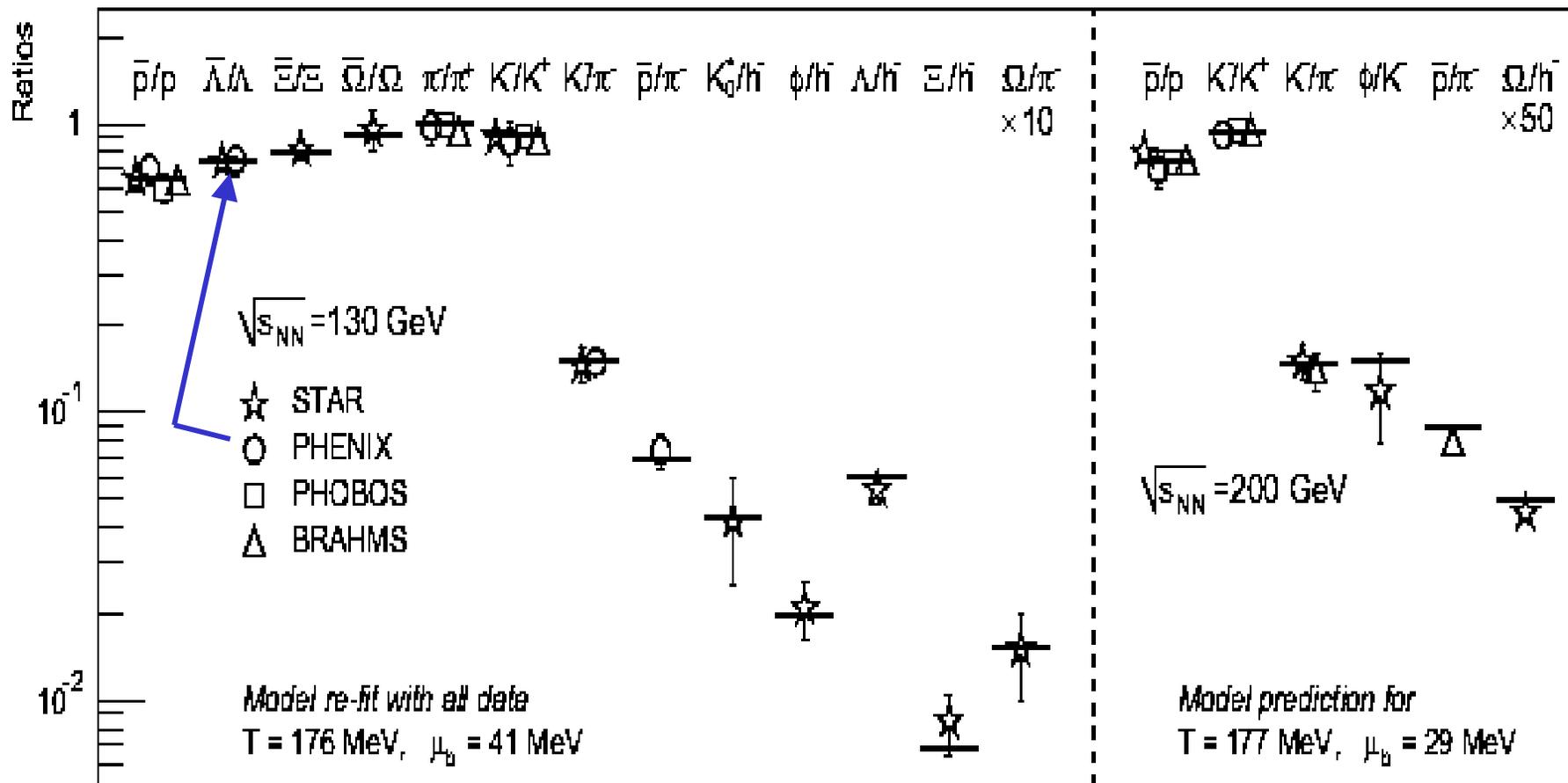
$\frac{\bar{N}_n}{\bar{N}_p}$ Ratio Au+Au at 130 GeV

- Ratios are constant as a function of transverse momentum and the number of participants (centrality)

- Ratios are consistent with statistical thermal model calculations

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Statistical model prediction for RHIC



P. Braun-Munzinger et al., PLB 518(2001) 41

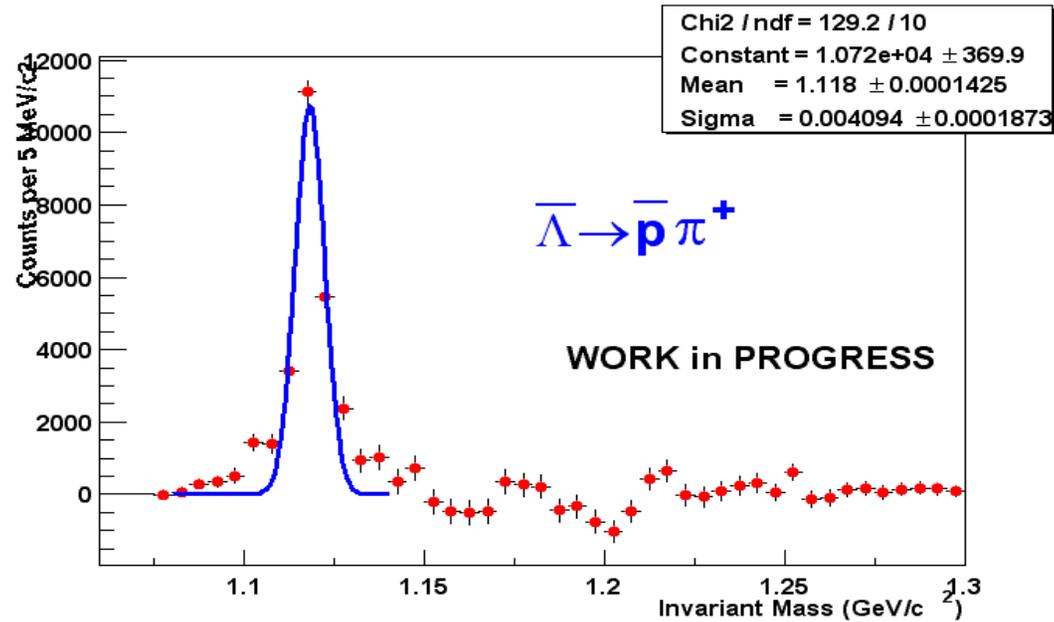
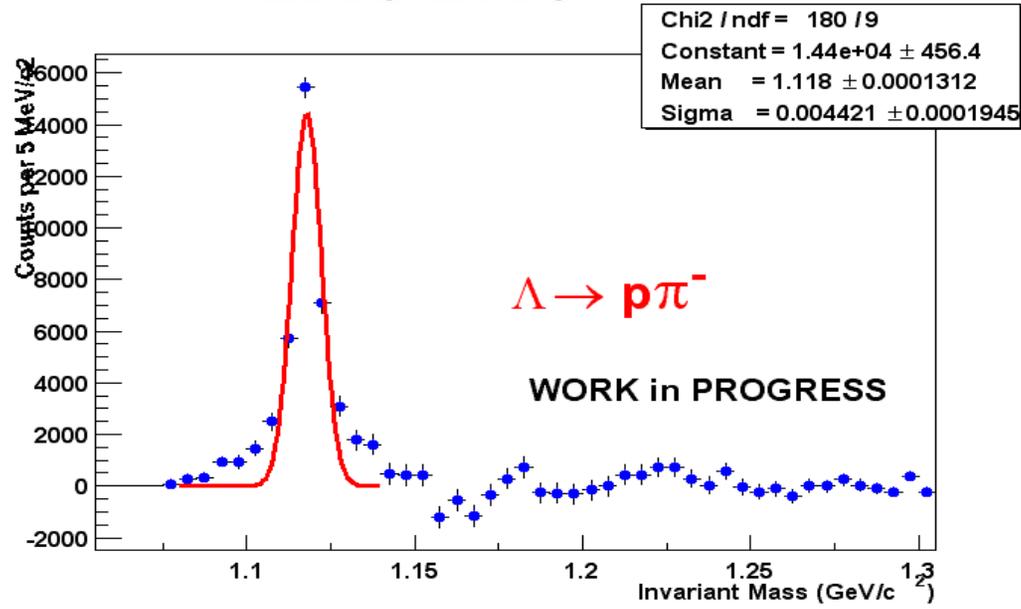
The net baryon numbers are indicative of the baryon transport mechanism.

	PHENIX	<i>HIJING</i>	HIJING/B
$(\Lambda - \bar{\Lambda})_{MB}$	1.3 ± 0.4	0.2	0.8
$(p - \bar{p})_{MB}$	1.7 ± 0.3	1.1	1.7
$(\Lambda - \bar{\Lambda})_{5\%}$	4.6 ± 2.5	0.8	3.2
$(p - \bar{p})_{5\%}$	5.6 ± 0.9	4.7	7.1

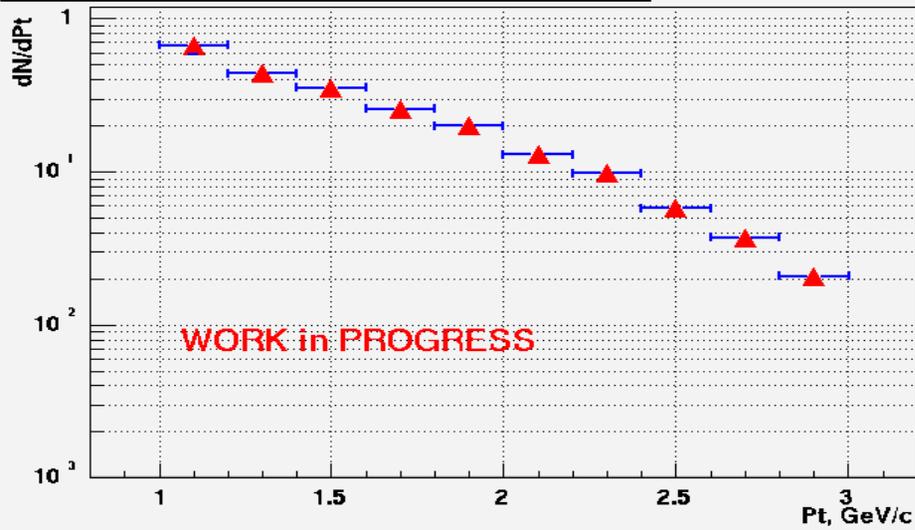
The measured net Lambda density is significantly larger than predicted by models based on hadronic strings (*HIJING*) but is in approximate agreement with models which include the gluon junction mechanism.

EMC-EMC

$$\sqrt{s_{NN}} = 200 \text{ GeV}$$

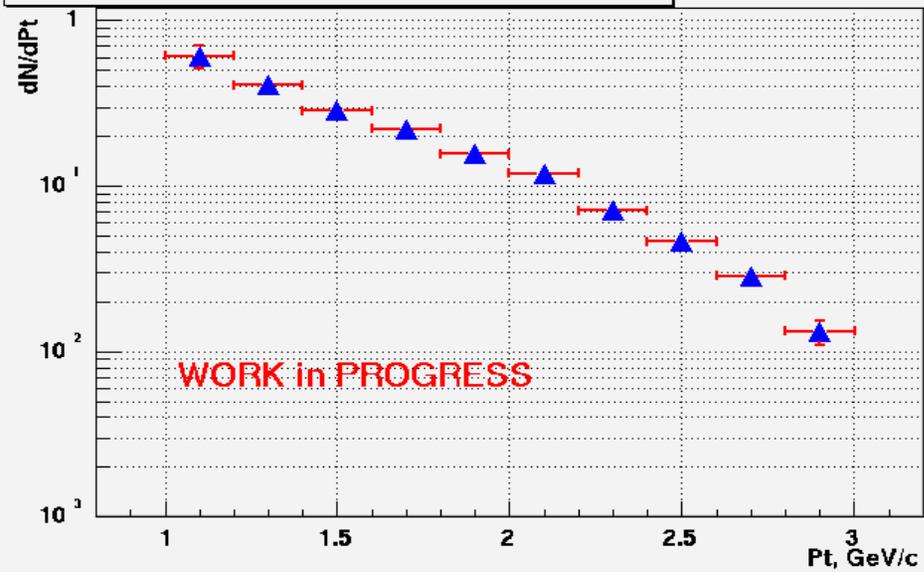


Δ , Au-Au, minimum bias events, 200 GeV



$$\sqrt{s_{NN}} = 200 \text{ GeV}$$

$\bar{\Lambda}$, Au-Au, minimum bias events, 200 GeV



Year-1 (130 GeV)

- Constant $\Lambda\text{-bar}/\lambda$ ratio observed as a function of:
 - p_T
 - N_{part}
 - Ratio consistent with prediction of statistical model

Year2 (200 GeV)

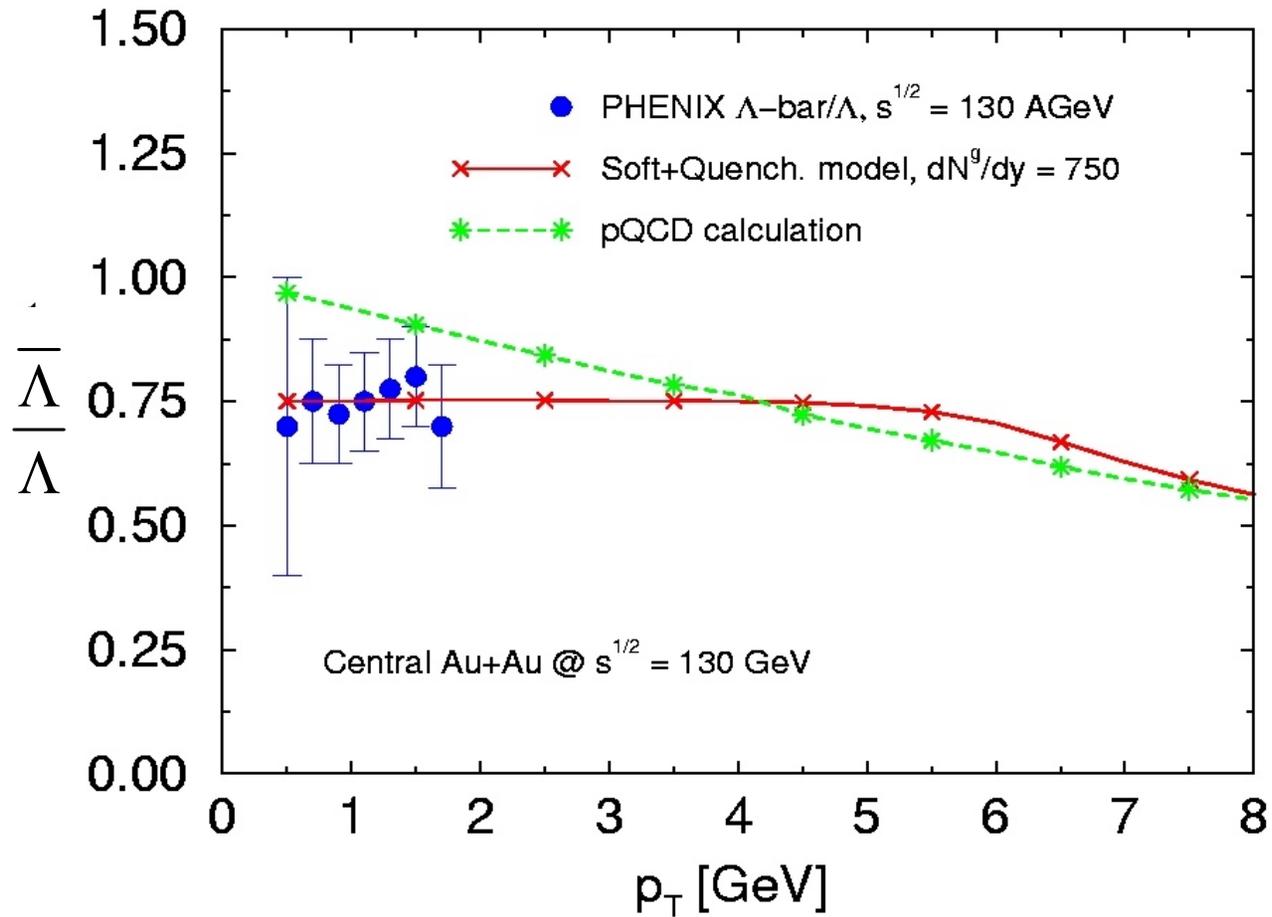
- Data Analysis complete – acceptance/efficiency corrections being refined.

Year-1 (130 GeV)

- Constant $\bar{\Lambda}/\Lambda$ ratio observed as a function of:
 - p_T
 - N_{part}
 - Ratio consistent with prediction of statistical model
- Net Λ density is in approximate agreement with models which include the gluon junction mechanism.

Year2 (200 GeV)

- Analysis still in progress



I. Vitev, M. Gyulassy, hep-ph/0208108