Identified Hadron Spectra and Baryon Stopping in \( \gamma + \text{Au} \) Collisions at STAR

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Isolating \( \gamma A \) collisions by using the ZDC and requiring rapidity gaps.
**Motivations**

**Baryon Stopping**

Energy needed to produce particles in heavy-ion collisions comes from kinetic energy lost by baryons in the colliding nuclei

- Larger effect in collisions with higher multiplicity (smaller impact parameter)
- Net-baryon yield can be estimated from the net-proton yield: difference in number of protons and antiprotons
- Cannot be fully explained by pure string fragmentations

See Ben Kimelman's Talk: QCD matter at finite temperature and density | Tuesday 6:10 pm

**Baryon Junction**

Nonperturbative configuration of gluons linked to all three valence quarks

- Carries baryon number
- Theorized to be an effective mechanism of stopping baryons in pp and AA


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**Photonuclear Events**

Can be used to study baryon stopping with the cleanest possible process

- $q\bar{q}$ + Baryon Junction producing a midrapidity proton
- $q\bar{q}$ pair would not be able to stop baryons if the baryon number was carried by all three valence quarks


STAR Preliminary
Central AA collisions
• $dN/dy_{lab}/(N_{part})$

Fit: $1.1 \exp(-0.61\delta y)$
Defining $\gamma A$ and Peripheral $AA$ Event Classes

Most photonuclear events have low multiplicity, concentrated at equivalent $Au + Au$ centrality of roughly 80%.

Using peripheral events as a baseline comparison, multiplicity consistent with $60 - 80\% Au + Au$. 
\[ p_T \] Dependence of Particle Ratios in \( \gamma A/AA \)

Double ratio
\[ K/\pi < 1 \text{ and flat with } p_T \]
→ less access to strangeness in \( \gamma A \) events
\[ \bar{p}/\pi \text{ and } p/\pi \text{ steeper than } K/\pi \]
→ larger radial flow in 60 – 80% Au + Au
\[ \bar{p}/\pi^- < p/\pi^+ \text{ for } p_T \approx 1 \text{ GeV/c} \]
→ soft baryon stopping

Not corrected for efficiency, but largely canceled in the ratio
Double ratio: $\bar{p}/p < 1$ at lower $p_T$

- Soft baryon stopping that is stronger in $\gamma A$ compared to peripheral $AA$
- Ratio is smaller at higher rapidity ($A$-going side)