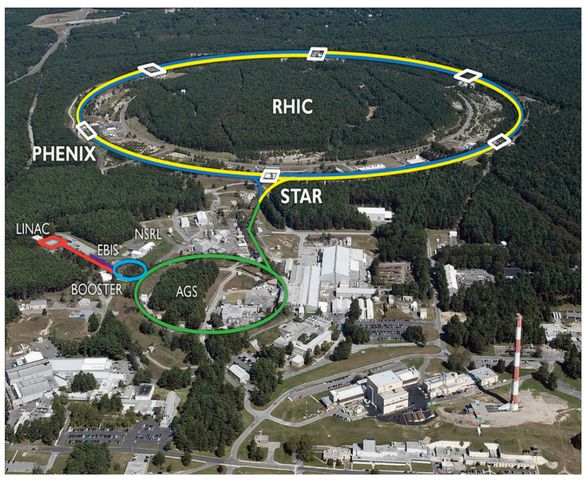
Strangeness production in U+U collisions at STAR

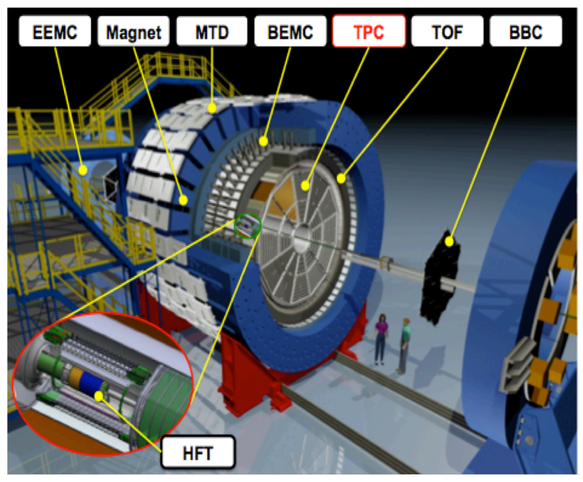
Srikanta Kumar Tripathy
Institute of Physics, Bhubaneswar, India
for the STAR Collaboration

Abstract

We report a measurements of strange hadron (V_0 and cascade) spectra in U+U collisions at $\sqrt{s_{NN}}$ = 193 GeV in the STAR experiment at RHIC. These strange particles were reconstructed via decay topology using the Time Projection Chamber (TPC) detector of STAR. We investigated particle identification, characterization and transverse momentum spectra of single- and multi-strange hadrons. (uncorrected) Yield of the particles are extracted for the momenta up to 7 GeV/c.

The STAR Experiment at RHIC



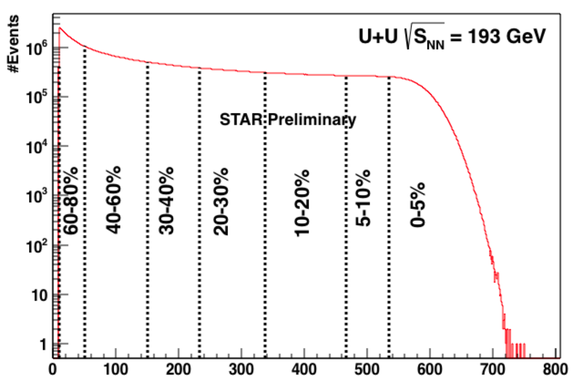


- Colliding systems:
p+p, p+Al, Cu+Cu, p+Au, d+Au, He+Au, Cu +Au, Au+Au, **U+U**
- Center of mass energy:
$\sqrt{s_{NN}}$ = 7.7 to 200 GeV
- Magnetic field: 0.5 T
- Large acceptance: $|\eta| < 1.0$, $0 < \varphi < 2\pi$
- Excellent particle identification capabilities (using Time Of Fight and Time Projection Chamber)

TPC is the key detector in this analysis.

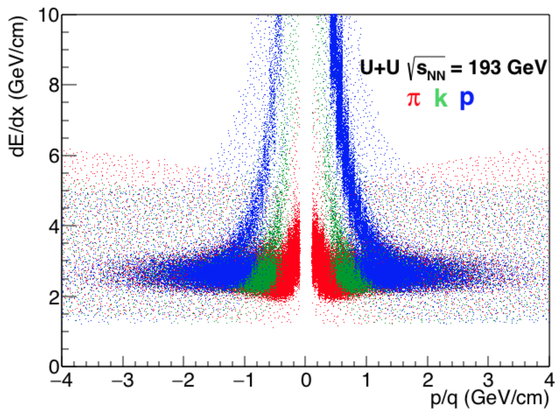
Analysis Technique

	Dominant decay mode / B. R. (in %)	Mass (in MeV/c²)	Decay length (in cm)	Mean Life time (in ×10⁻¹⁰s)
K_s	ππ / 69.2 ± 0.5	497.614 ± 0.024	2.68	0.8954 ± 0.0004
Λ	pπ / 63.9 ± 0.5	1115.683 ± 0.006	7.89	2.632 ± 0.020
Ξ	Λπ / 99.887 ± 0.035	1321.71 ± 0.07	4.91	1.639 ± 0.015
Ω	ΛK / 67.8 ± 0.7	1672.45 ± 0.29	2.46	0.821 ± 0.11



Reference multiplicity:
Number of charged particles with $|\eta| < 0.5$

$$\eta = \frac{1}{2}\left(\frac{|\vec{p}|+p_z}{|\vec{p}|-p_z}\right) = -\ln\left[\tan\left(\frac{\theta}{2}\right)\right]$$



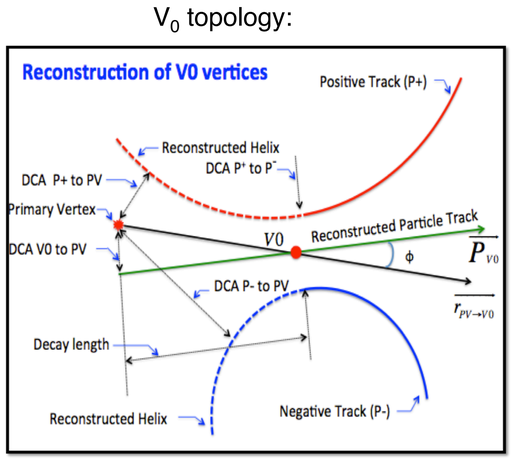
Particle identification:

Charged particles were identified via their ionization energy loss in the TPC gas.

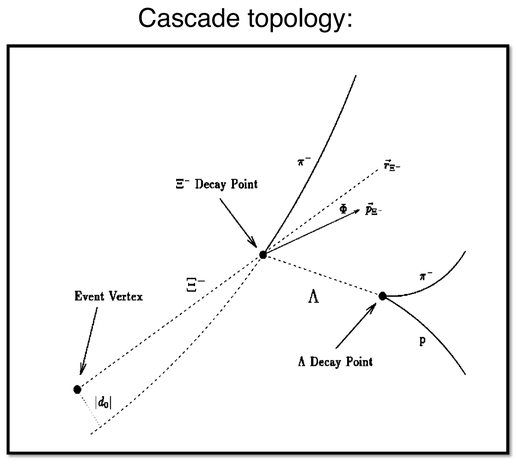
$$N\sigma = \frac{1}{R} \times \log\left(\frac{dE/dx_{\exp}}{dE/dx_{theory}}\right)$$

Ref:
1) M. Anderson (STAR collaboration) Nucl. Instrum. Meth. A **499** (2003) 659
2) Ming Shao et. al. Nucl. Instrum. Meth. A **558** (2006) 419
3) Yichun Xu et. al. Nucl. Instrum. Meth. A **614** (2010) 28

V_0 topology:



Cascade topology:



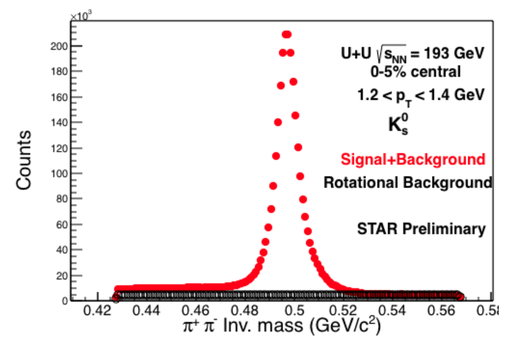
Signal Extraction

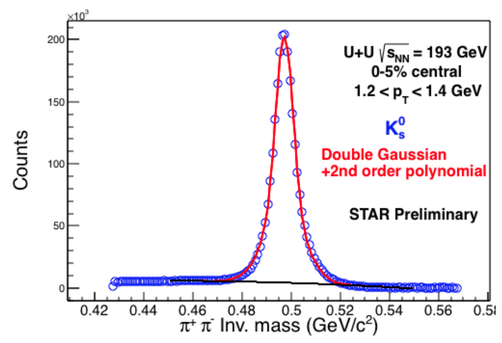
Invariant mass = $\sqrt{(E_1+E_2)^2-(\vec{p}_1+\vec{p}_2)^2}$

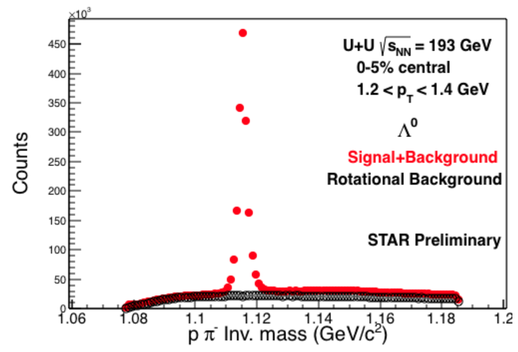
Background was estimated by rotating one of the daughter particles in the azimuthal space.

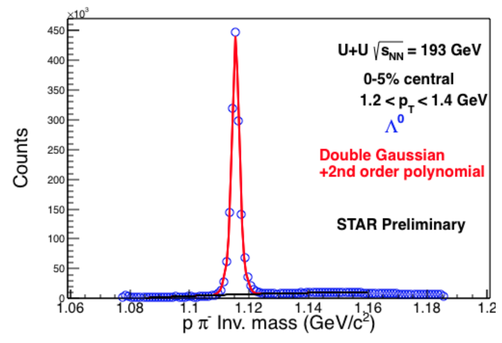
In order to extract yields, invariant mass distributions were fitted with:

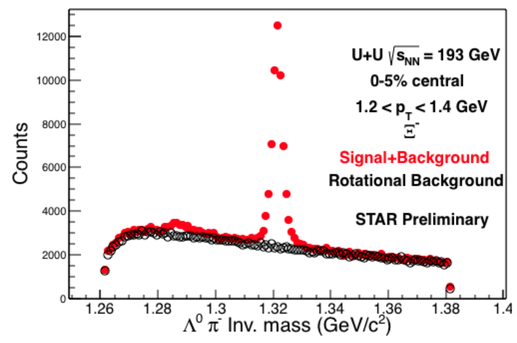
$$a*exp(\overline{x-\mu}/\sqrt{2}b)^2 + c*exp(\overline{x-\mu}/\sqrt{2}d)^2 + p_0 + p_1x + p_2x^2$$

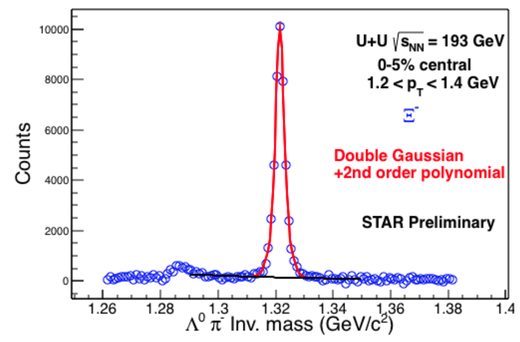




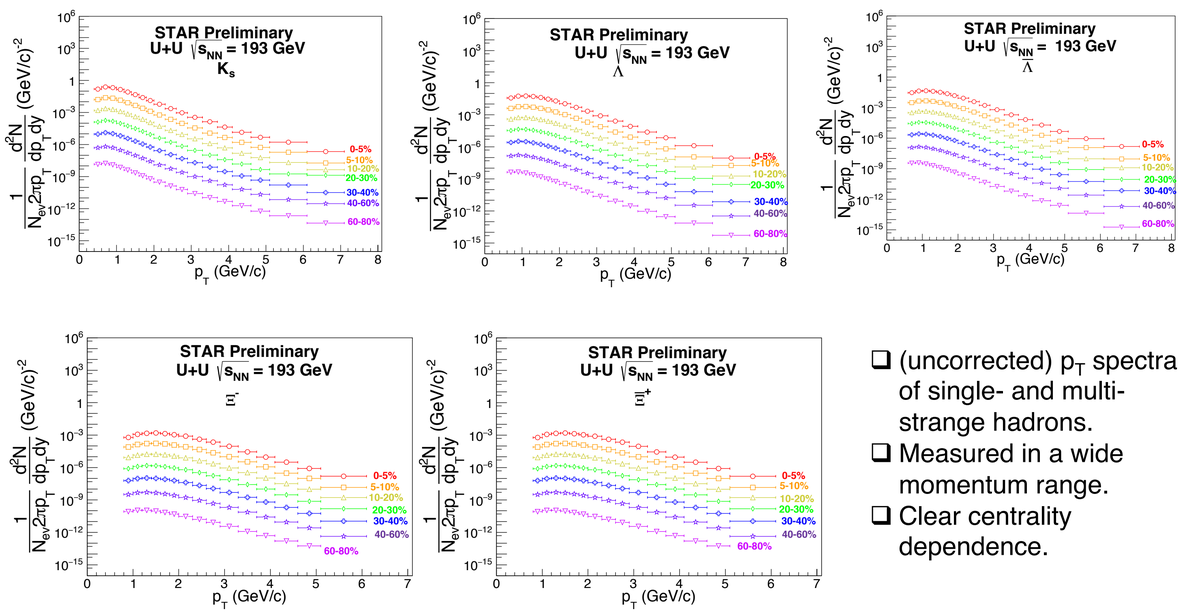








Raw spectra



- (uncorrected) p_T spectra of single- and multi-strange hadrons.
- Measured in a wide momentum range.
- Clear centrality dependence.

Summary and Outlook

- Measurement of single- and multi-strange hadrons in U+U collisions at $\sqrt{s_{NN}}$ = 193 GeV using via hadronic decay channel.
- d^2N/dp_Tdy spectra show a clear centrality dependence.
- The (uncorrected) spectra are measured in a wide momentum range.
- Centrality, energy and p_T-dependent efficiency and acceptance corrections will be applied to (un-corrected) spectra, allowing to estimate yield and thus particle ratios.