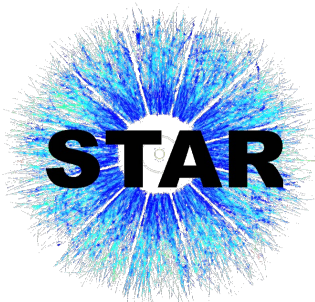# Hypertriton Production in Au+Au Collisions from Beam Energy Scan-II

Yuanjing Ji

for the STAR Collaboration

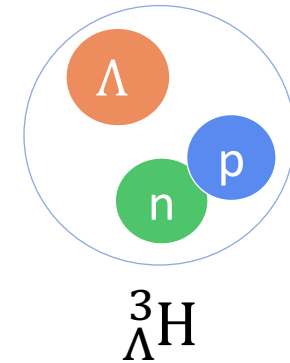Lawrence Berkeley National Laboratory

Motivation

Hypernucleus: **A bound system of** **nucleons with $\geq$ 1 hyperons**

Hypernuclei in heavy ion collisions

- Hyperon-Nucleon (*Y-N*) interactions
- Equation-of-State of dense nuclear matter at high μ_B
- Production mechanisms

$^{3}_{\Lambda}\text{H}$

Thermal model: B. Dönigus, Eur. Phys. J. A 56:280 (2020)
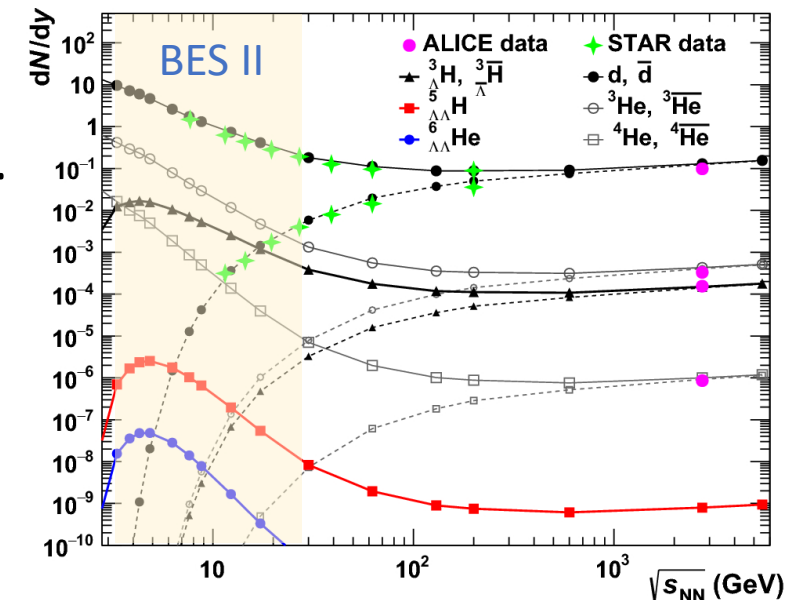A. Andronic et al, PLB 697, 203 (2011)

Observables:

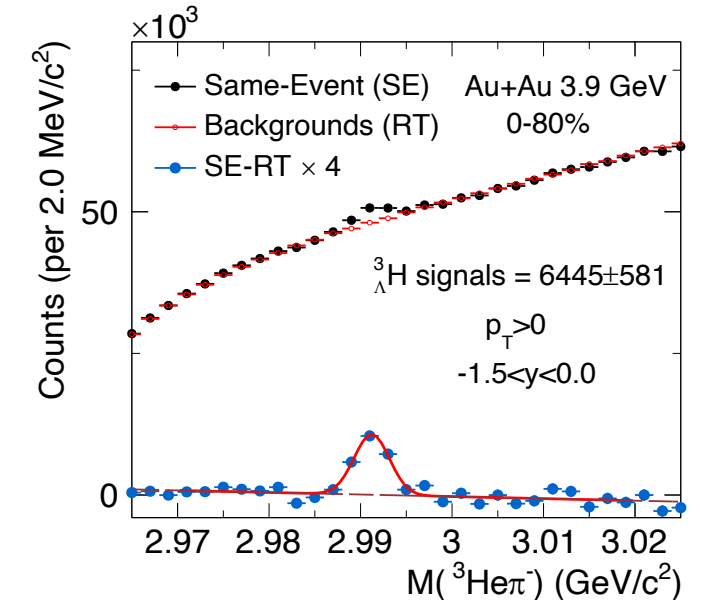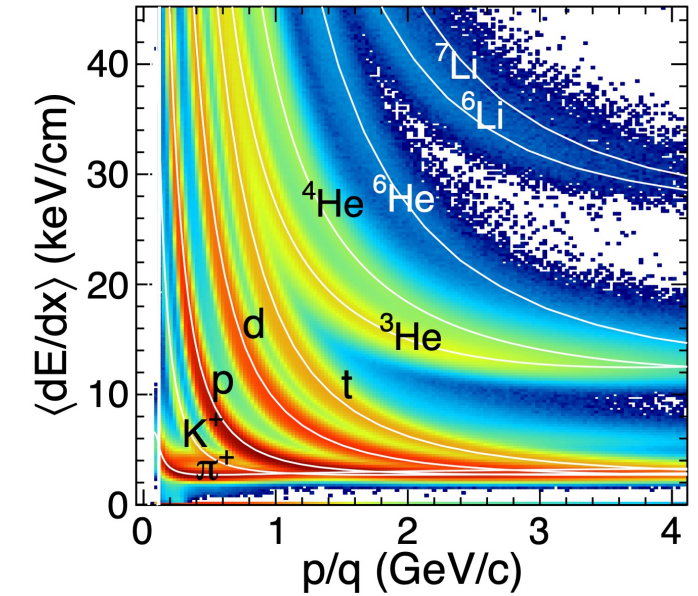- Lifetime, binding energy, branching ratio, yield, collectivity …

Results in this presentation:

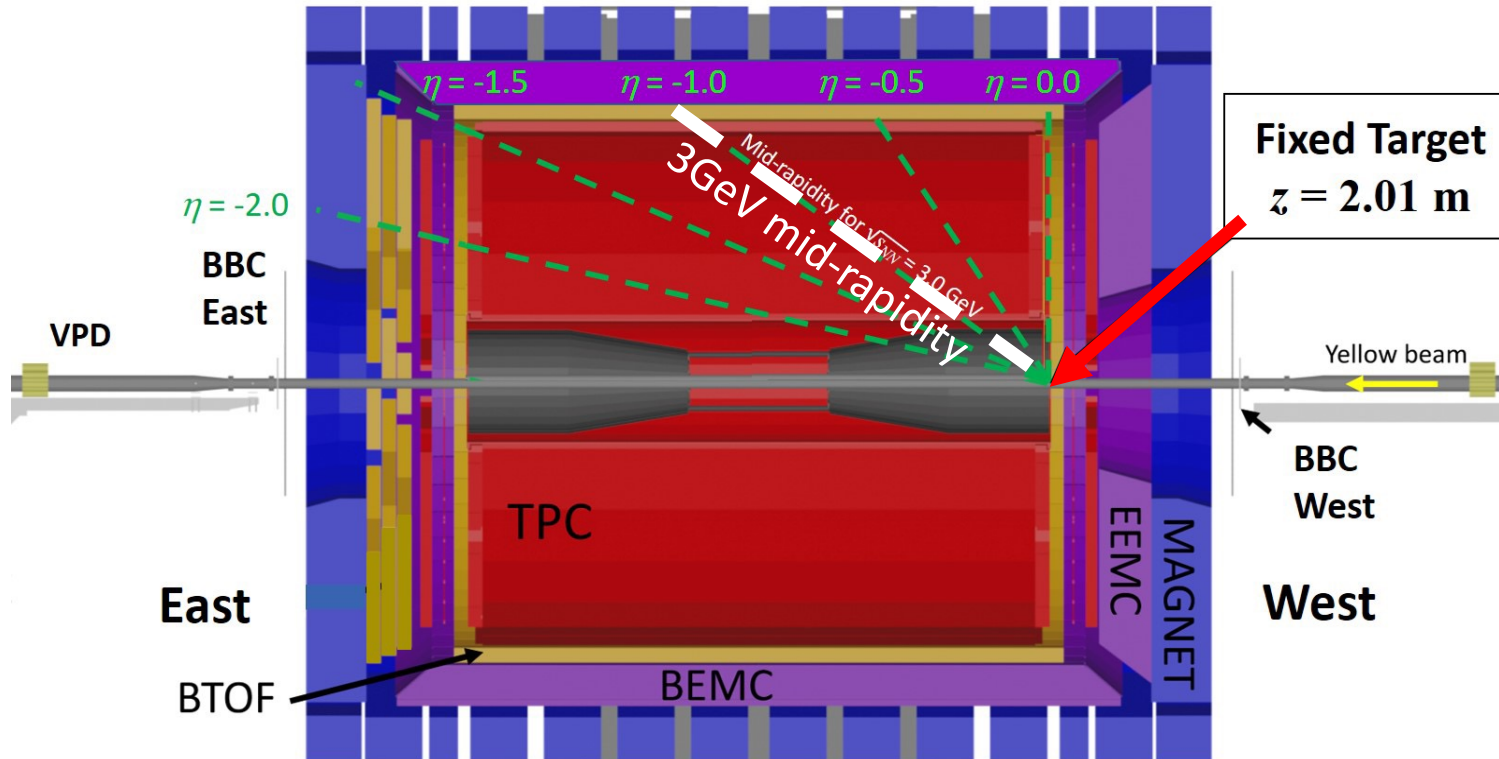- dN/dy (y, $\sqrt{s_{NN}}$), $\langle p_T \rangle$ from STAR Beam Energy Scan-II
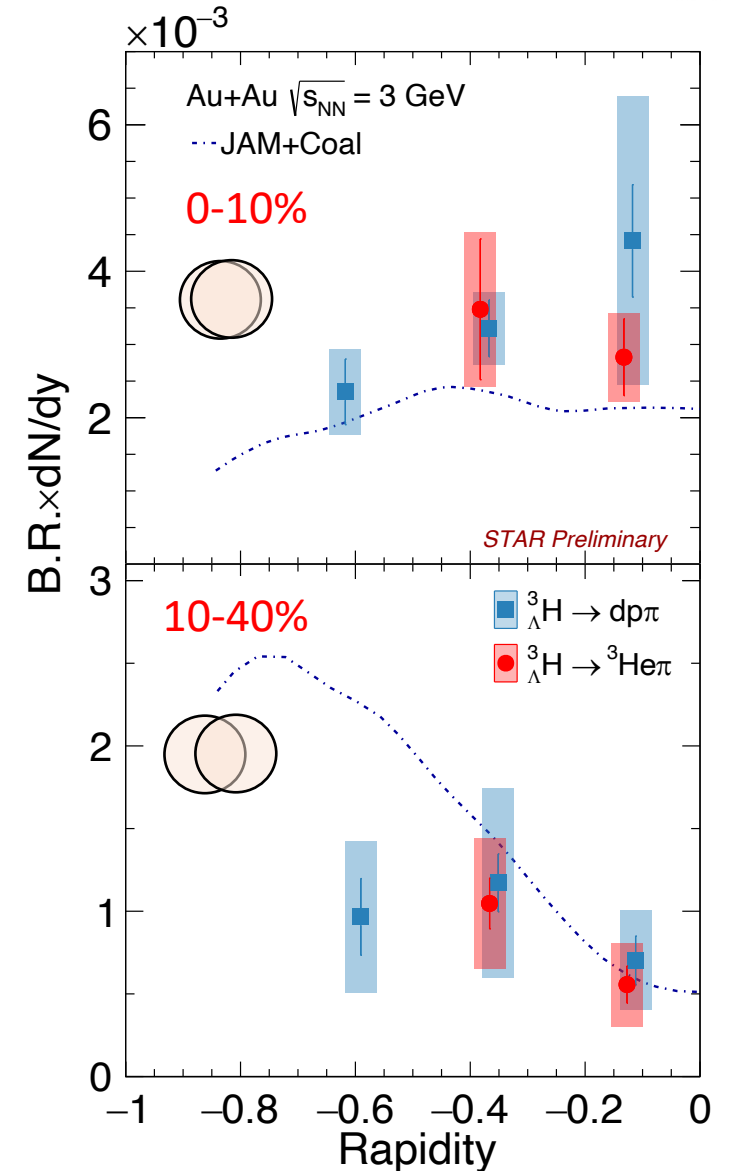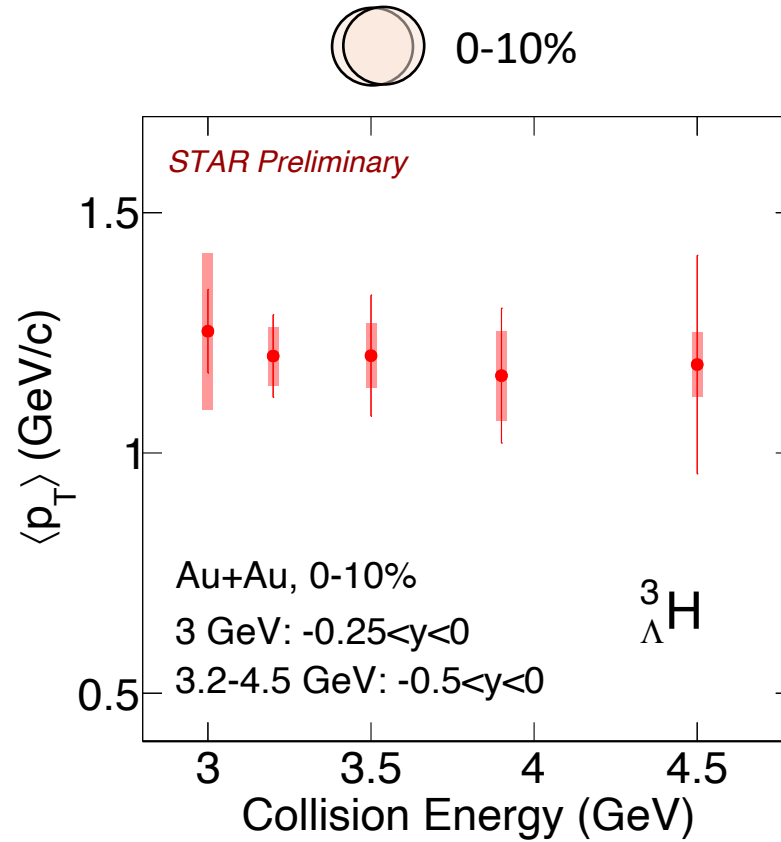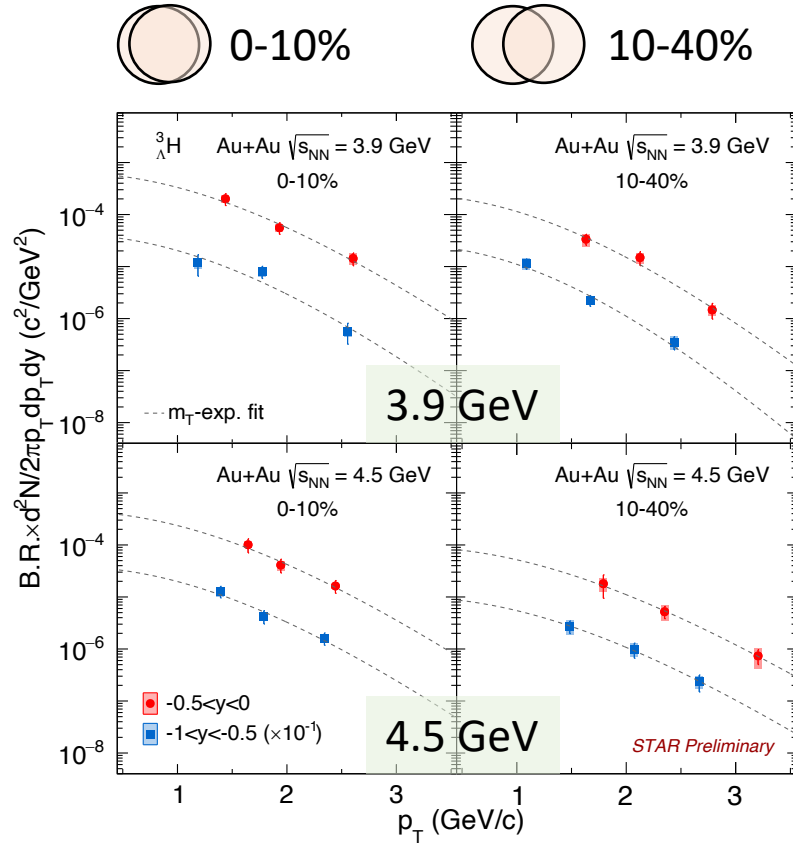- Comparison with hyperon/light nuclei

Experimental Setup and $^{3}_{\Lambda}\text{H}$ Reconstruction

- STAR BES-II - energy coverage 27 − 3 GeV (μ_B: up to 720 MeV)
  - *Datasets from 2018-2020 used in this presentation*
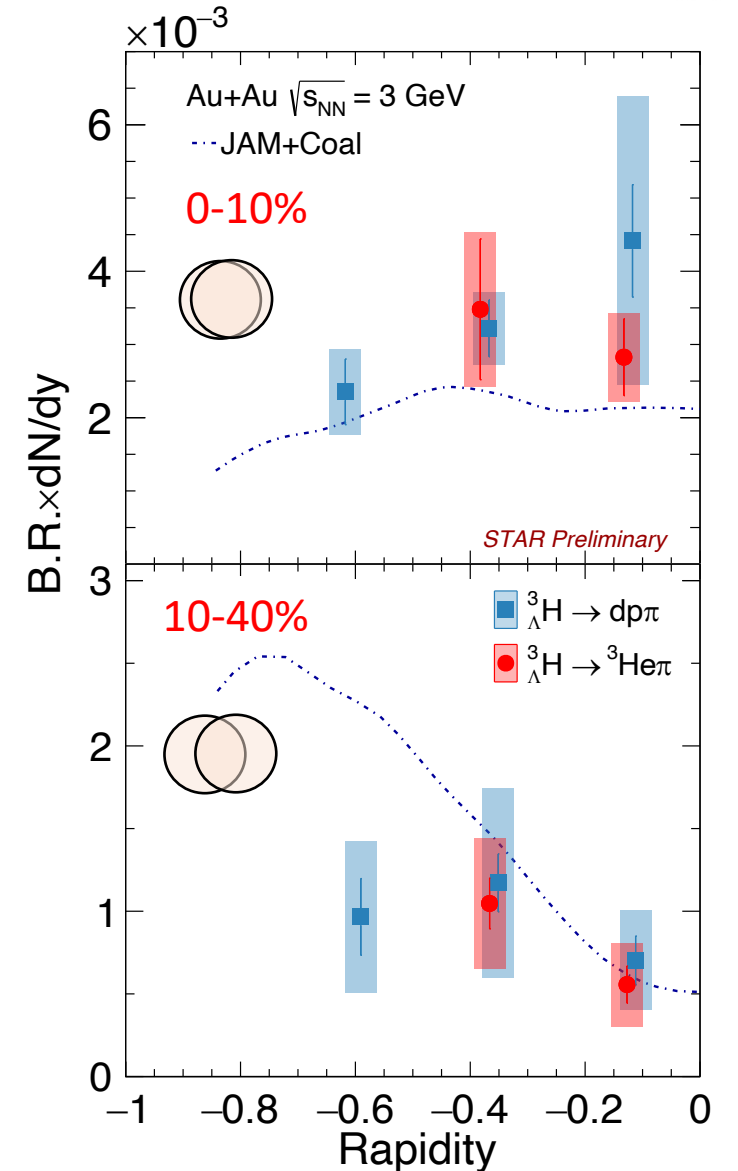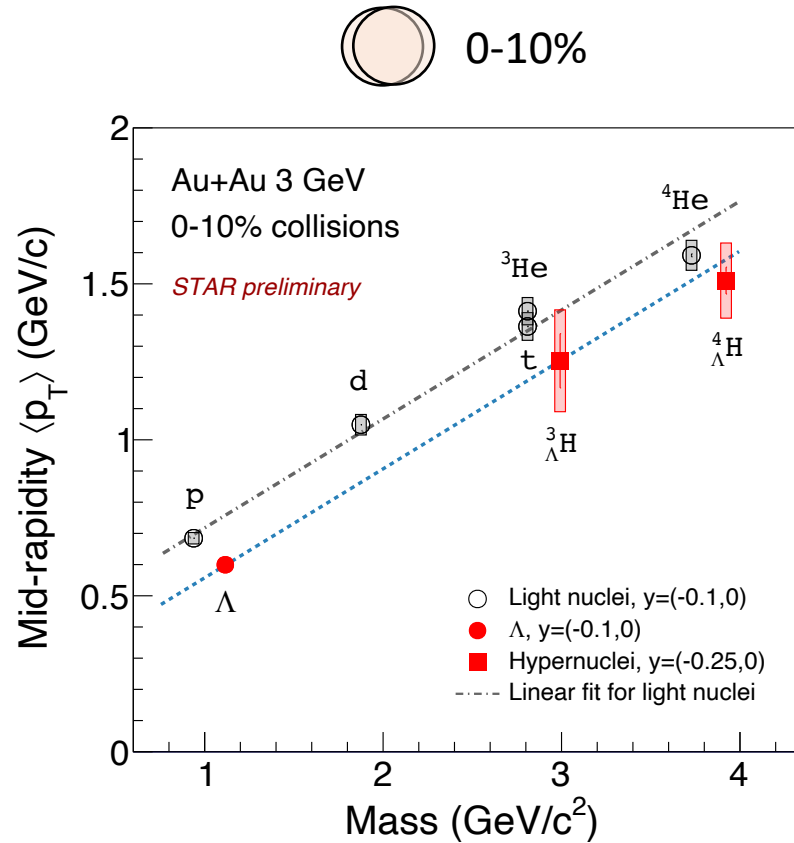- Reconstruction channel: $^{3}_{\Lambda}\text{H} \rightarrow ^{3}\text{He} + \pi^-$

Hypernuclei p$_T$ Spectra, $\langle p_T \rangle$, dN/dy

Au+Au central collisions
- Hypernuclei $\langle p_T \rangle$ follows the mass number scaling
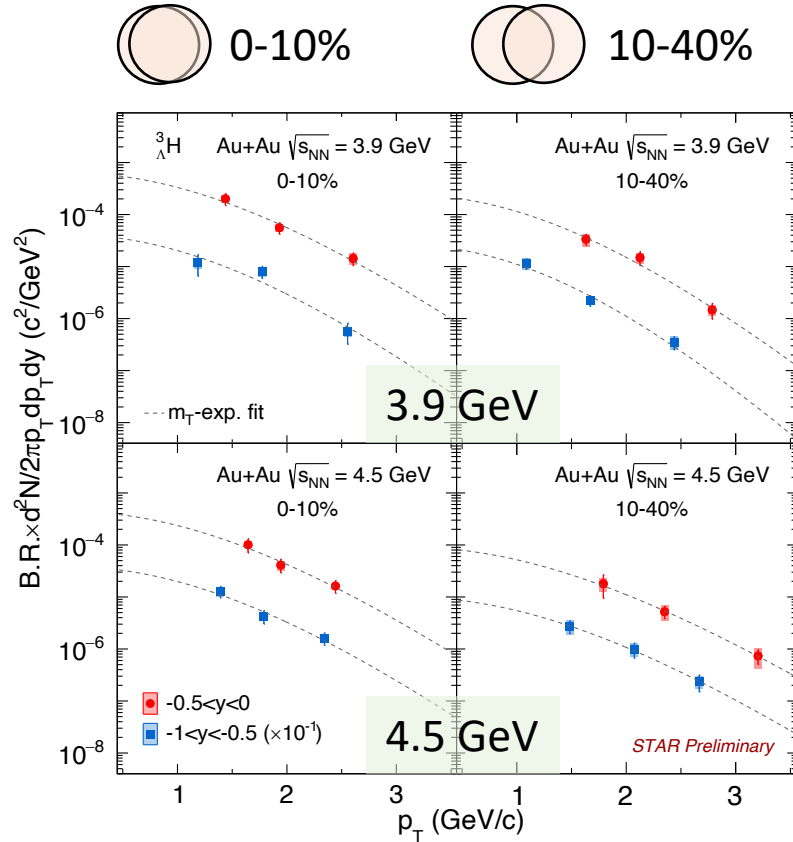- dN/dy vs. y qualitatively described by JAM + Coalescence

Hypernuclei p$_T$ Spectra, $\langle p_T \rangle$, dN/dy

0-10%   10-40%   0-10%

Au+Au central collisions
- Hypernuclei $\langle p_T \rangle$ follows the mass number scaling
- dN/dy vs. y qualitatively described by JAM + Coalescence

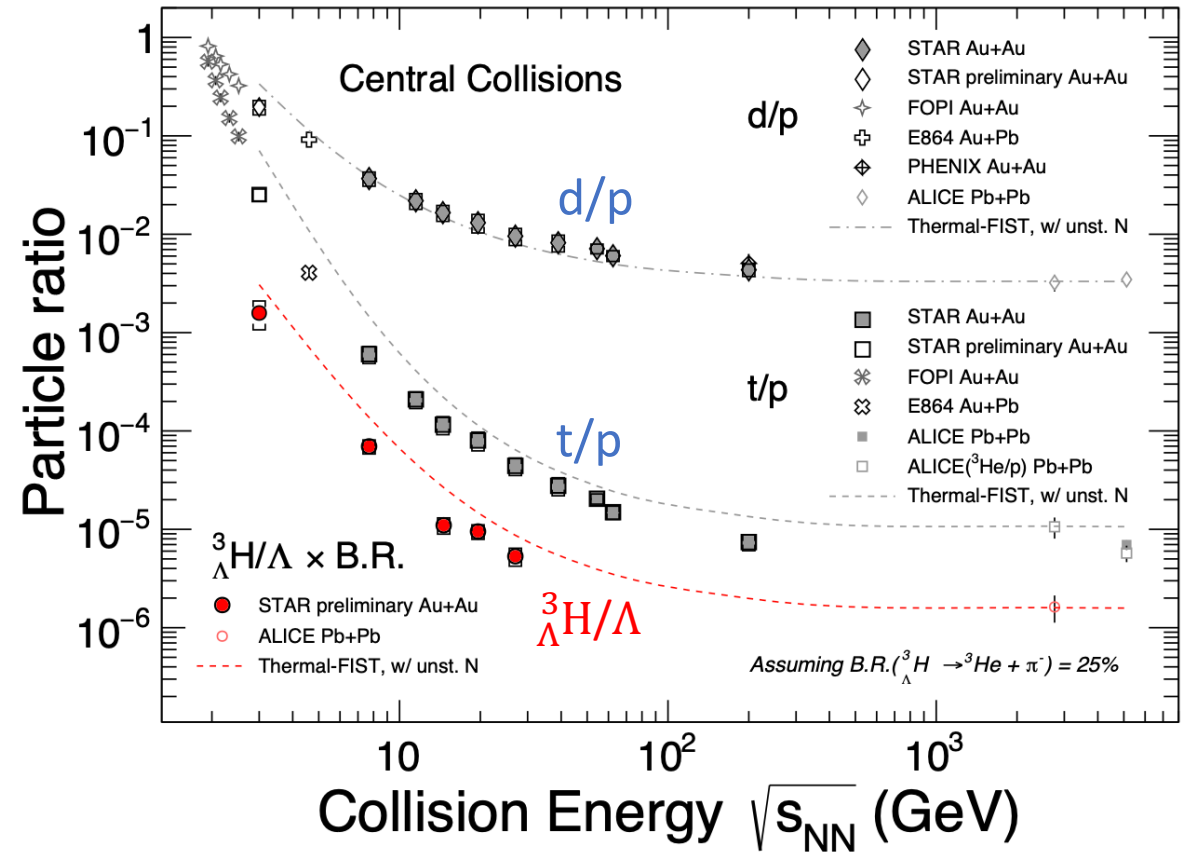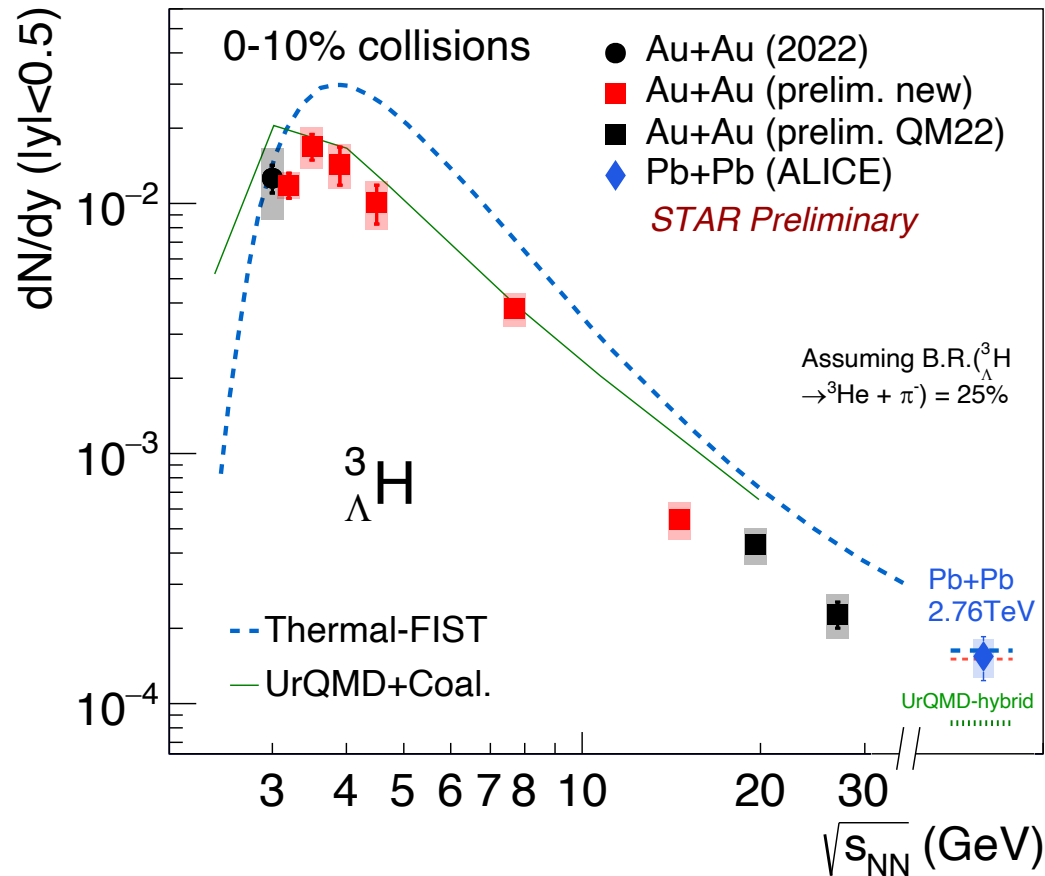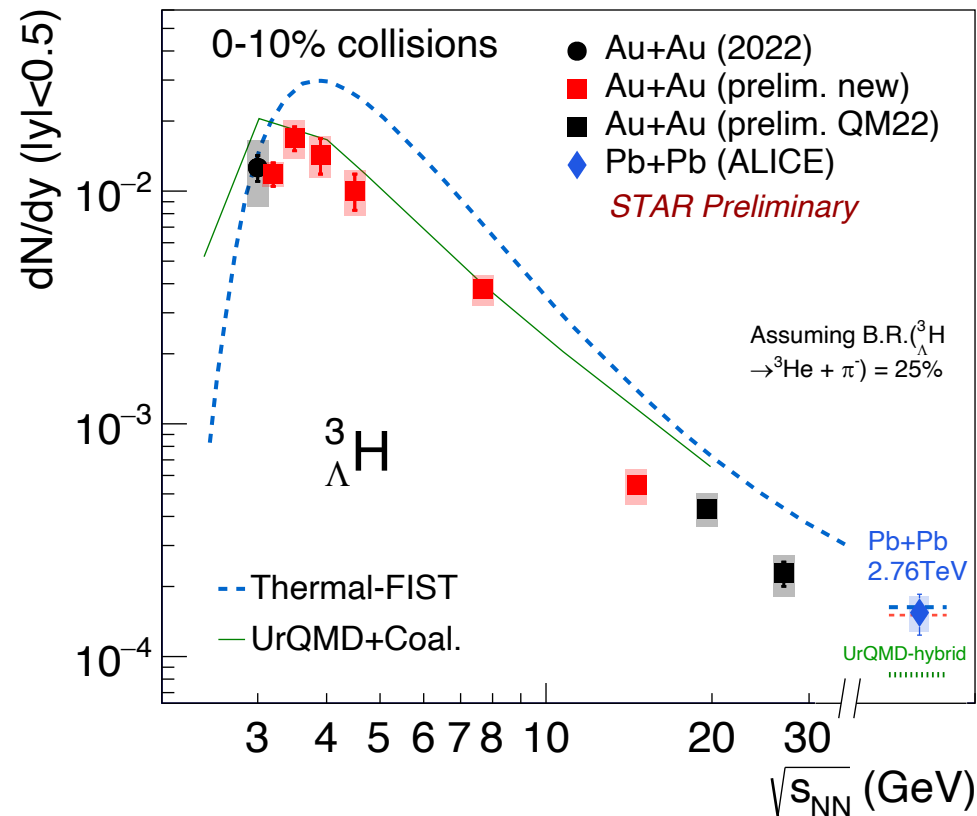# Energy Dependence of $^3_\Lambda$H Yield

- Hadronic transport + coalescence models qualitatively describe the data
- Thermal model calculation ~2 times higher than data in BES-II energies

Summary

${}^{3}_{\Lambda}H$ spectra, $\langle p_T \rangle$, dN/dy from Au+Au collisions at BES-II

- New constraints to model calculations towards understanding of *Y-N* interactions

0-10% collisions

- Au+Au (2022)
- Au+Au (prelim. new)
- Au+Au (prelim. QM22)
- Pb+Pb (ALICE)

STAR Preliminary

Assuming B.R.$({}^{3}_{\Lambda}H \rightarrow {}^{3}He + \pi^{-}) = 25\%$

${}^{3}_{\Lambda}H$

Pb+Pb 2.76TeV

-- Thermal-FIST
— UrQMD+Coal.

UrQMD-hybrid

Outlook

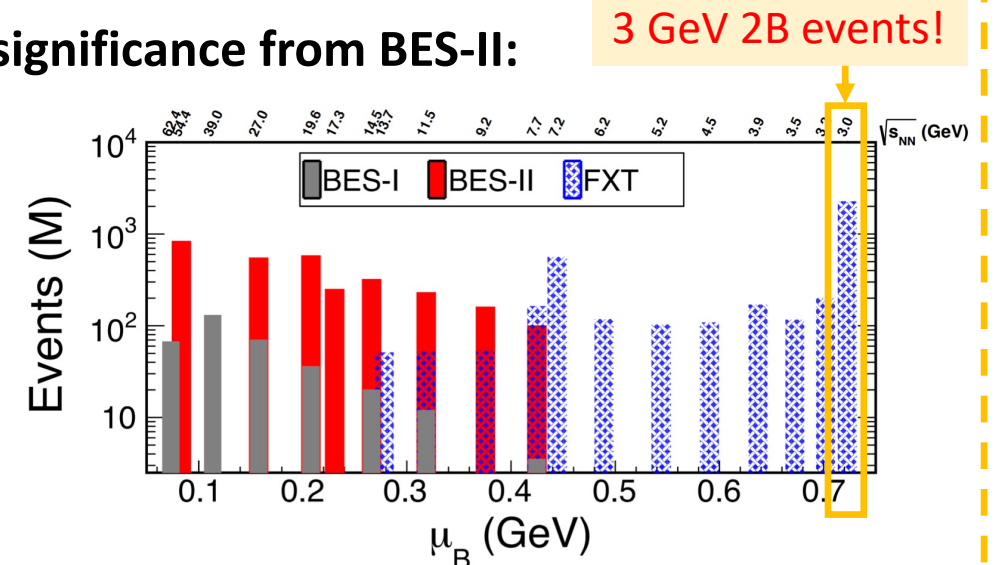Huge datasets from BES-II and 200 GeV collisions: $A\geq=4$ and double-Λ hypernuclei
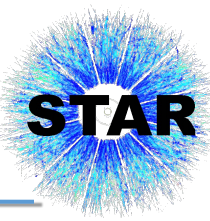
Expected significance from BES-II:

$${}^{4}_{\Lambda}H : 60\sigma$$

$${}^{4}_{\Lambda}He: 40\sigma$$

$${}^{5}_{\Lambda}He: 10\sigma$$

$${}^{A}_{\Lambda\Lambda}H : ???$$
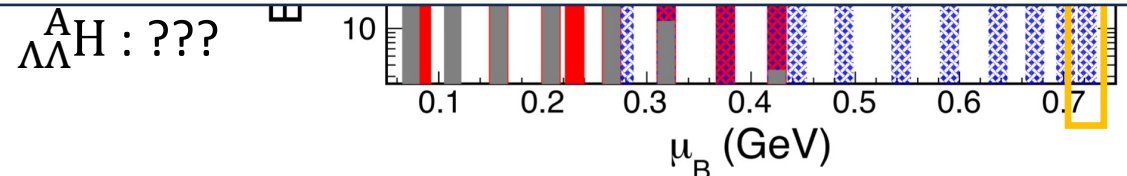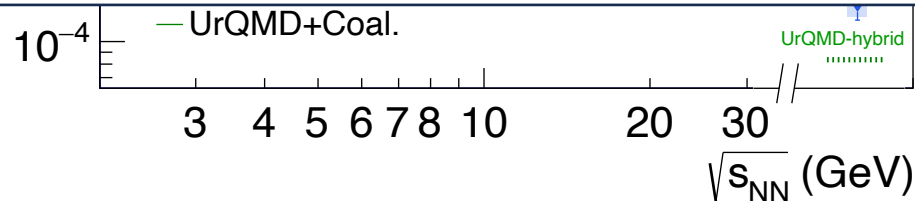
3 GeV 2B events!

BES-I BES-II FXT

7

Summary

$^{3}_{\Lambda}H$ spectra, $\langle p_T \rangle$, dN/dy from Au+Au collisions at BES-II

- New constraints to model calculations towards understanding of *Y-N* interactions

Outlook

Thank you: QM Poster Committee

Thank you: QM2023!

Thank you: STAR Collaboration

0-10% collisions   Au+Au (2022)

— UrQMD+Coal.

UrQMD-hybrid

10^{-4}

3 4 5 6 7 8 10   20 30

$\sqrt{s_{NN}}$ (GeV)

$^{A}_{\Lambda\Lambda}H$: ???

10

0.1 0.2 0.3 0.4 0.5 0.6 0.7

μ_B (GeV)