Outline

- Why Fixed Target?
- Event Selection
- dE/dx for Positively & Negatively Charged Particles
- Pion, Proton, and Light Nuclei Spectra
- Conclusions, Summary and Outlook

STAR as a Fixed Target Experiment

Au+Al at 2.8 AGeV

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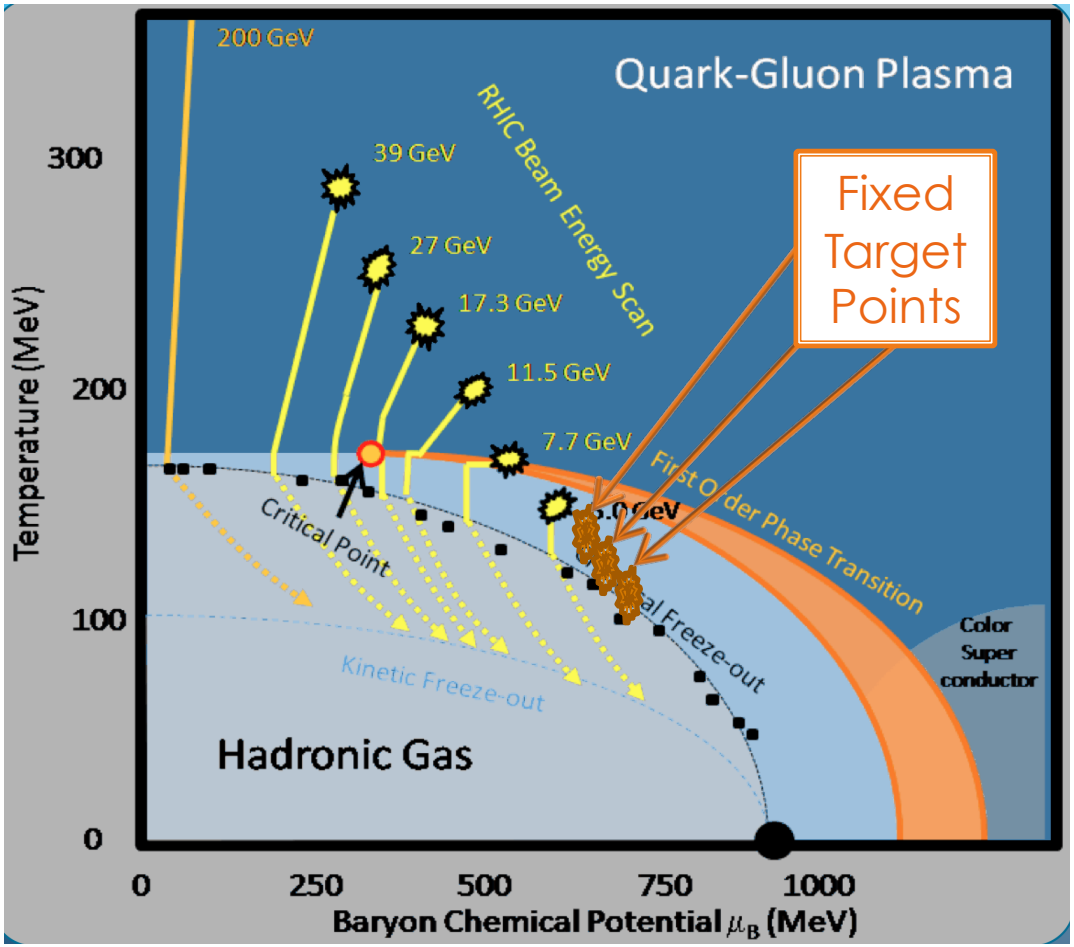
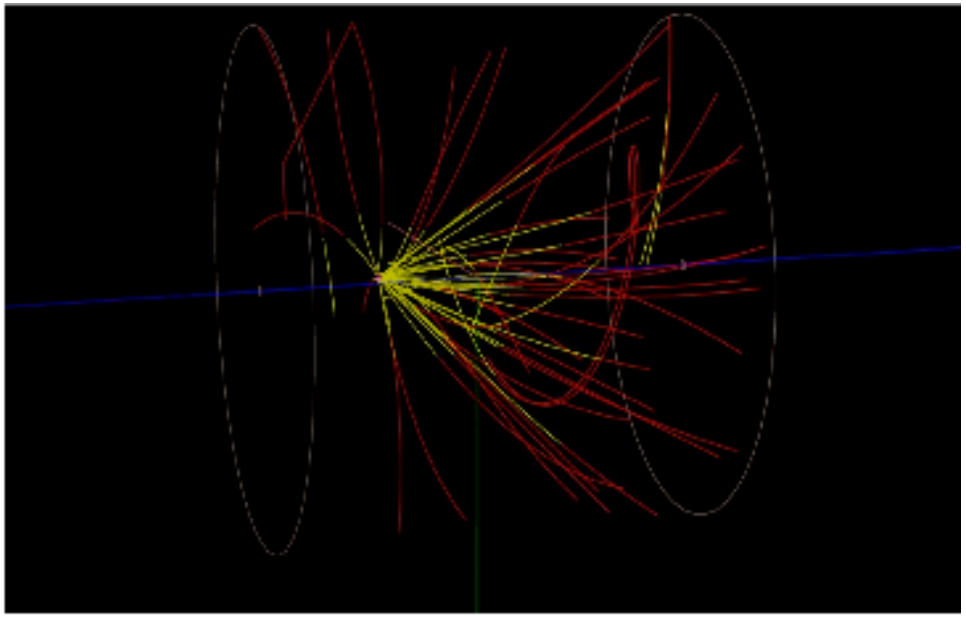
Why Study Fixed Target?



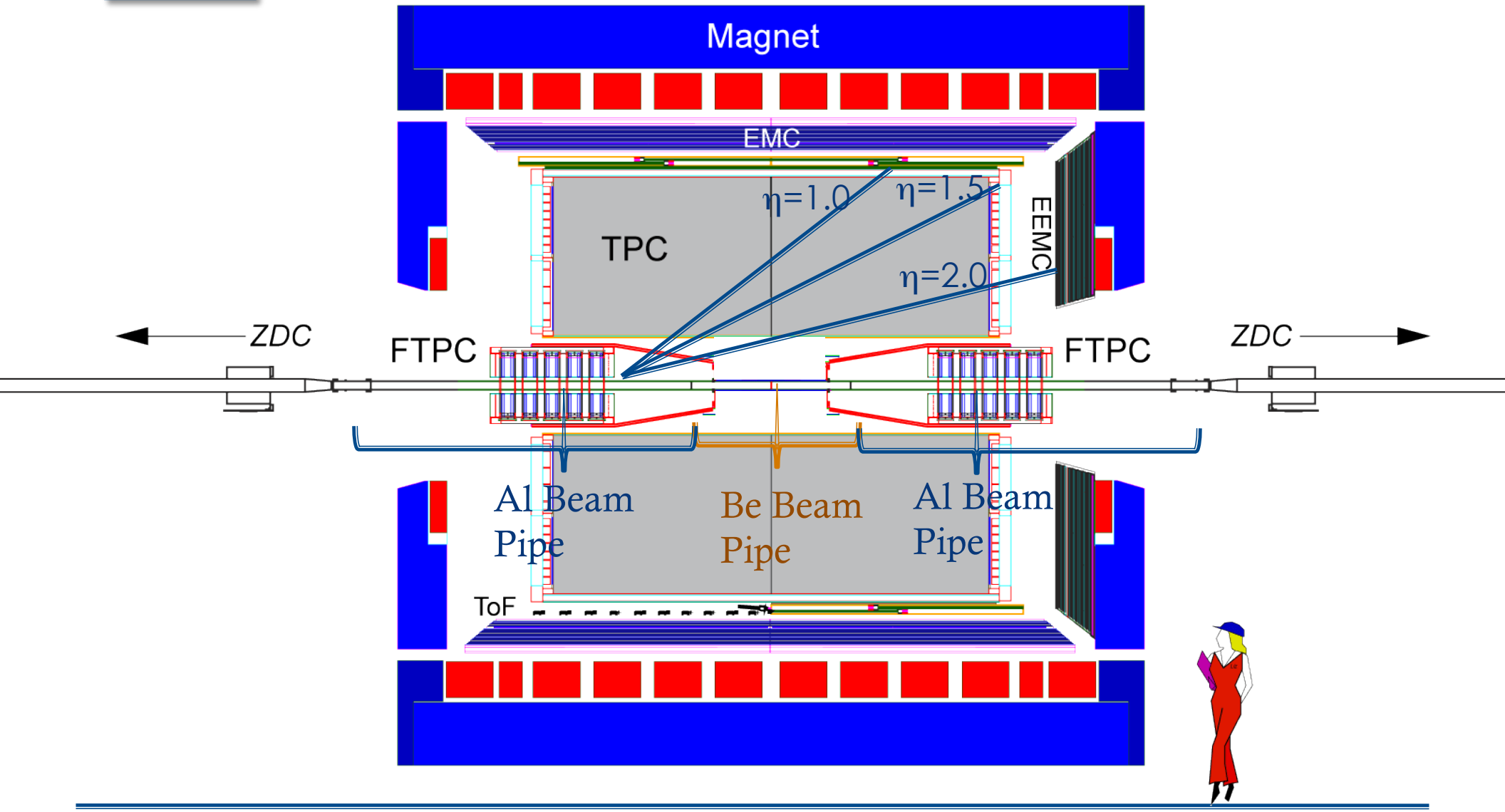
- Can extend low energy reach for Beam Energy Scan (BES)
- Allows STAR to compare results with previous AGS experiments

How to Study Fixed Target at a Collider

- Au ions in the beam collide with Al nuclei in the beam pipe
- STAR detector obtains useful data from these collisions
- Au+Al not the normal events analyzed at STAR
- These are one-sided collisions, not on the beam axis
- Must think carefully about detector geometry

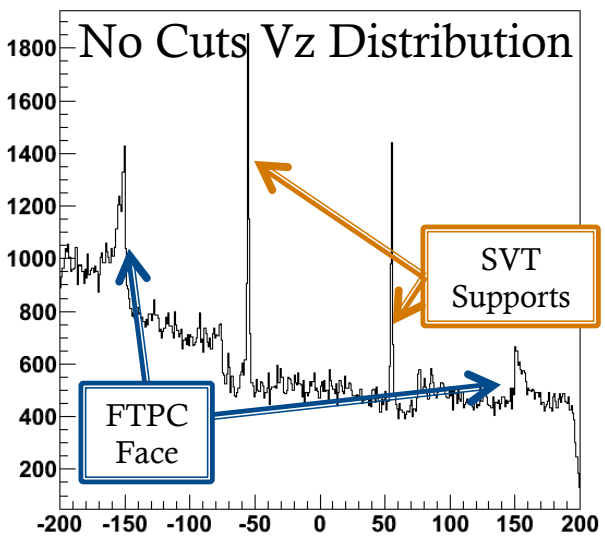


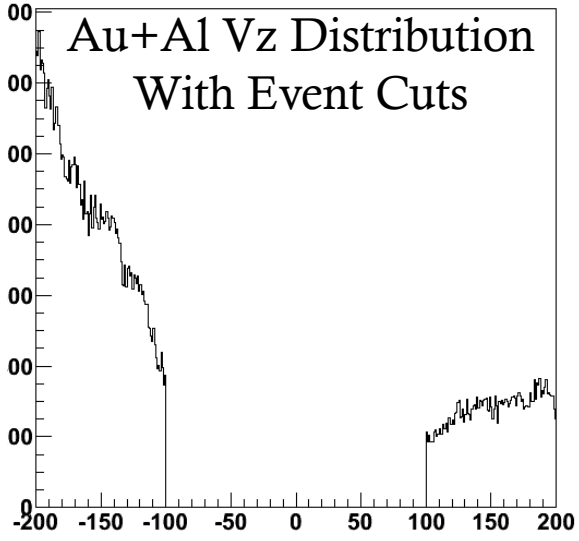
STAR Geometry for Fixed Target

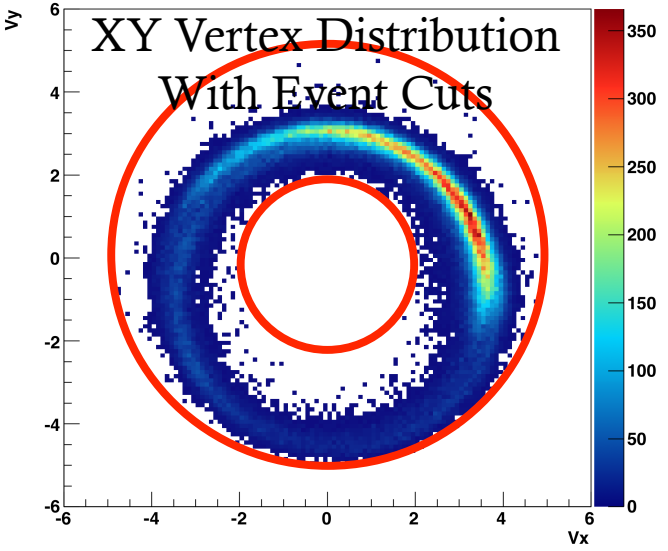


Event Selection

- Ensure Au+Al collisions
  - Require z-vertex position on Al portion of beam pipe via geometric cuts
- Ensure Event is on the beam pipe
  - Require radial vertex position near beam pipe radius
  - Removes vertices on FTPC face and SVT support structures

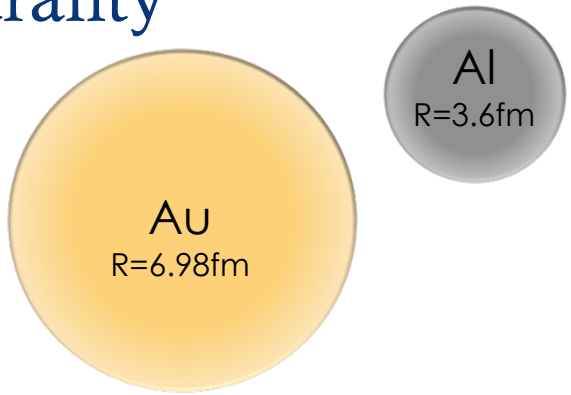


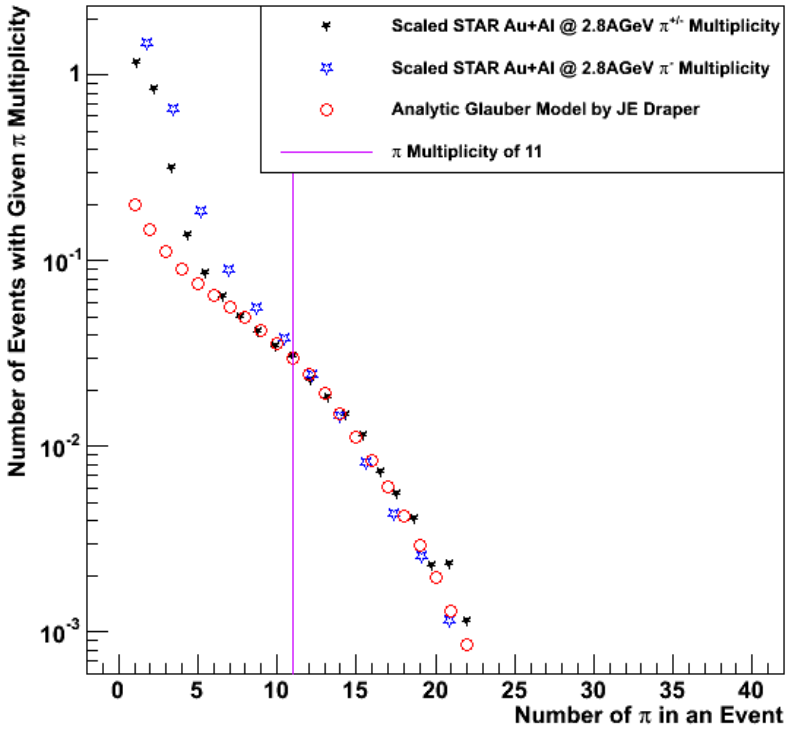




STAR Data – Determining Centrality

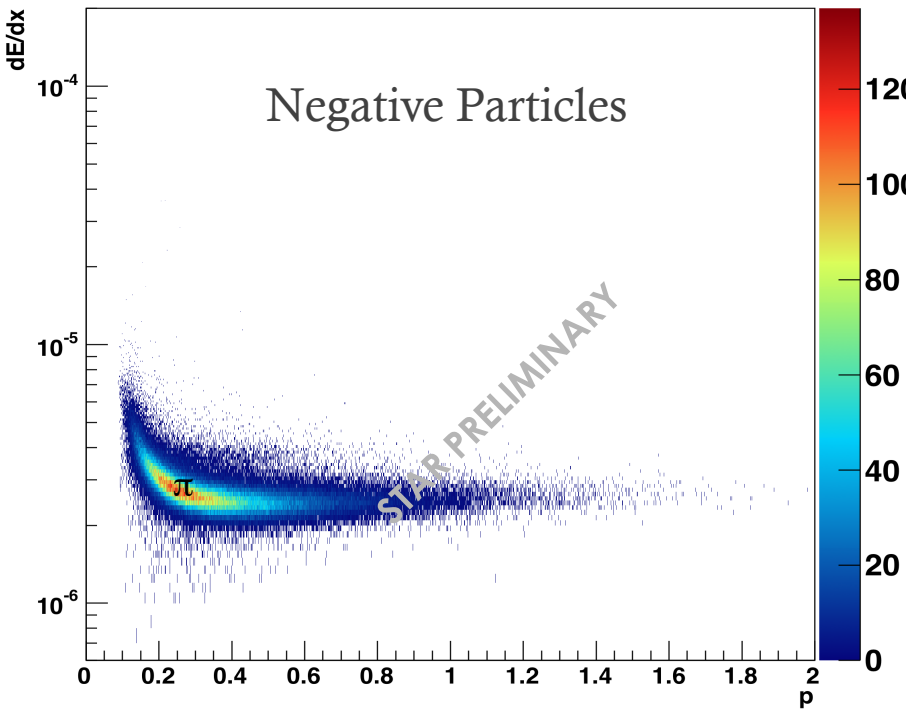
- Al nucleus can be completely absorbed by Au nucleus for a range of impact parameters
- Compare data to analytic Glauber Model
  - Find best observable to define collision centrality
- Total Charged Particle Multiplicity is a poor observable for centrality
  - Includes spectators from Al remnant
- Total π multiplicity matches best to Glauber distribution above M_π of 8
  - π are identified via dE/dx
- Cut on π multiplicity of 11
  - Some events with fewer π are not Au+Al
  - Defines top 40% of centrality

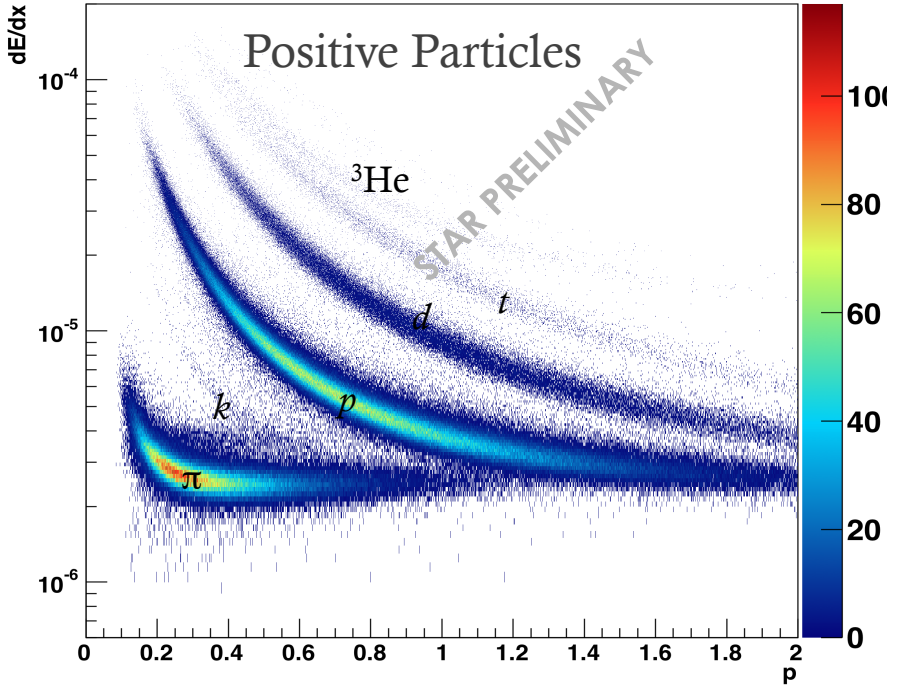




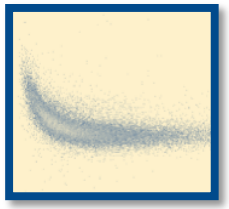
dE/dx for Charged Particles

Good particle identification through dE/dx





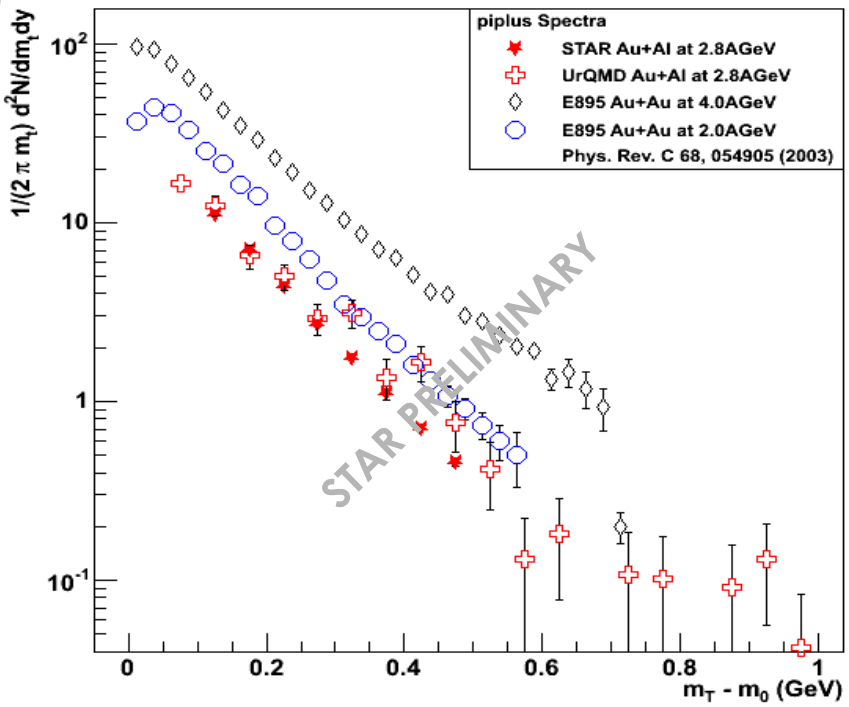
Momentum distribution does not populate overlap regions

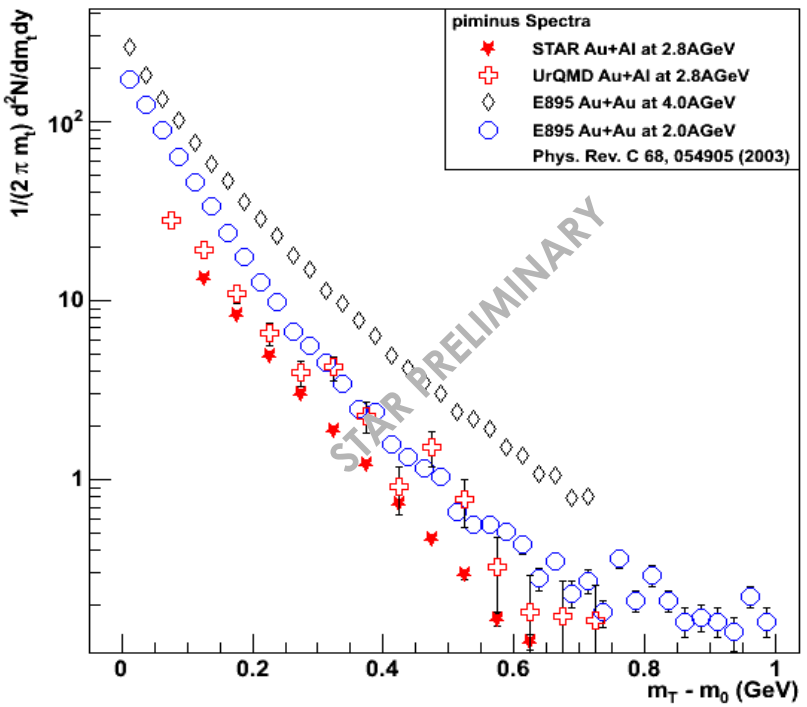


Particle Spectra

- Choose rapidity slices of 0.1 around mid-rapidity
  - Mid rapidity for Au+Al @ 2.8 AGeV is 1.05 in Lab frame
- Compare to E895 experiment (AGS) spectra at similar energies for top 5% centrality
  - Au+Au at 2.0 AGeV and 4.0 AGeV
- Looking at π^+, π^- and *p* spectra for top 40% central Au +Al at 2.8AGeV

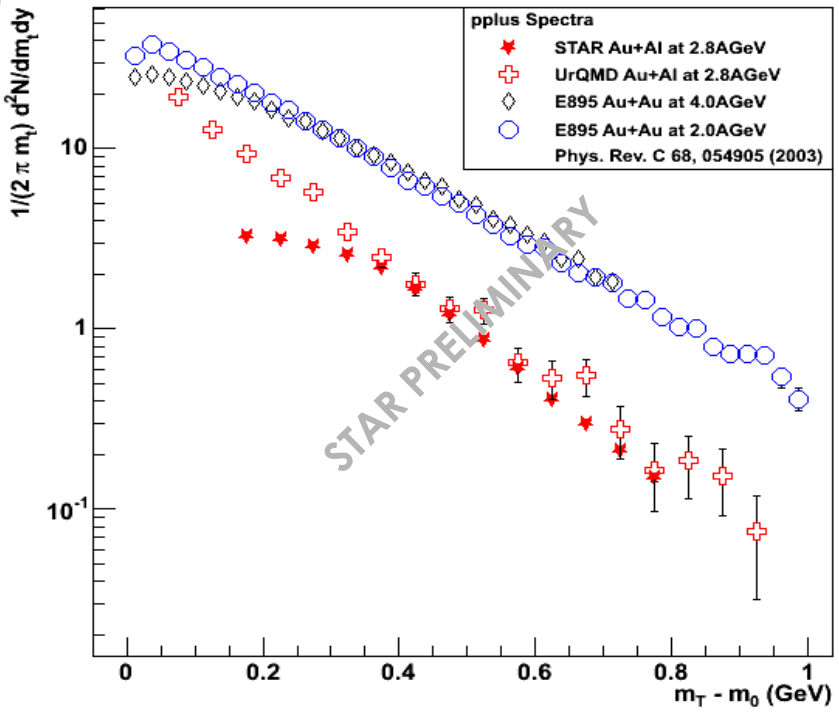
Au+Al 2.8 AGeV – Spectra π^+ and π^-

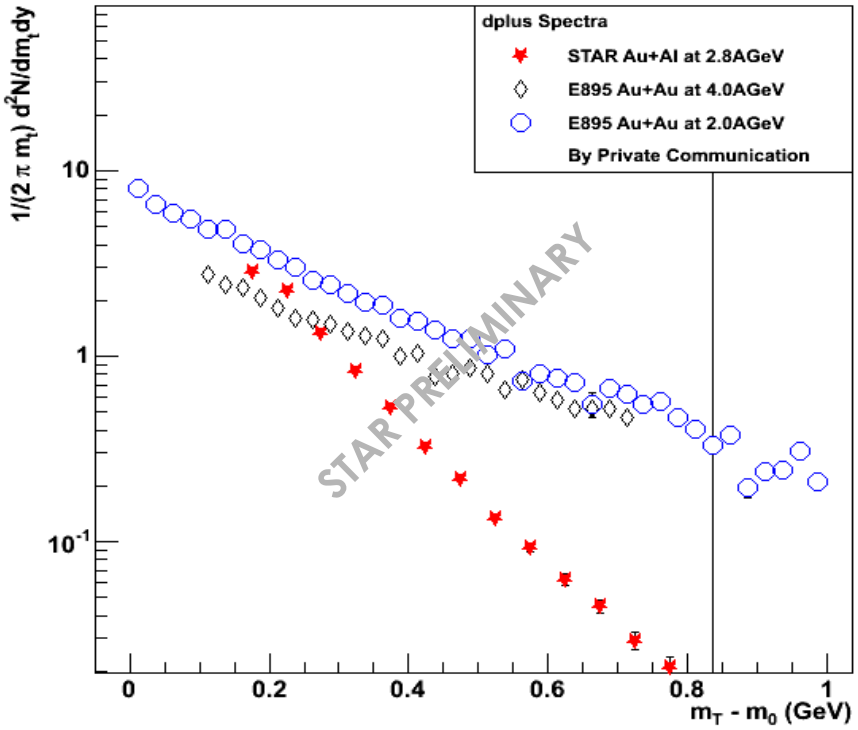




- No efficiency or acceptance corrections
  - Currently in progress
- Comparison to UrQMD suggests high efficiency for $\pi^{+/-}$

Au+Al 2.8 AGeV – Spectra *p* and *d*





- No efficiency or acceptance corrections
  - Currently in progress
- Can see an inefficiency in *p* spectrum at low end
- Need coalescence model to calculate *d* in UrQMD

Summary, Conclusions and Outlook

- STAR can be utilized as a fixed target experiment allowing us to analyze lower energies than those in the RHIC BES program
  - Will be helpful for the critical point search
- Spectra for π, p and light nuclei have been presented
- Will continue studies of other BES data including $\sqrt{s_{NN}}$ = 11.5, 39, 62 GeV Au+Au data sets
  - Corresponding fixed target Au+Al collisions energies are $\sqrt{s_{NN}}$ = 3.5, 6.2, 7.7 AGeV