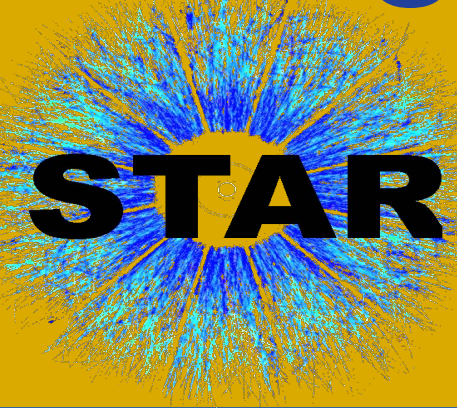


Charged Pion Production in $\sqrt{s_{NN}} = 3.0$ GeV Fixed-Target Collisions at STAR

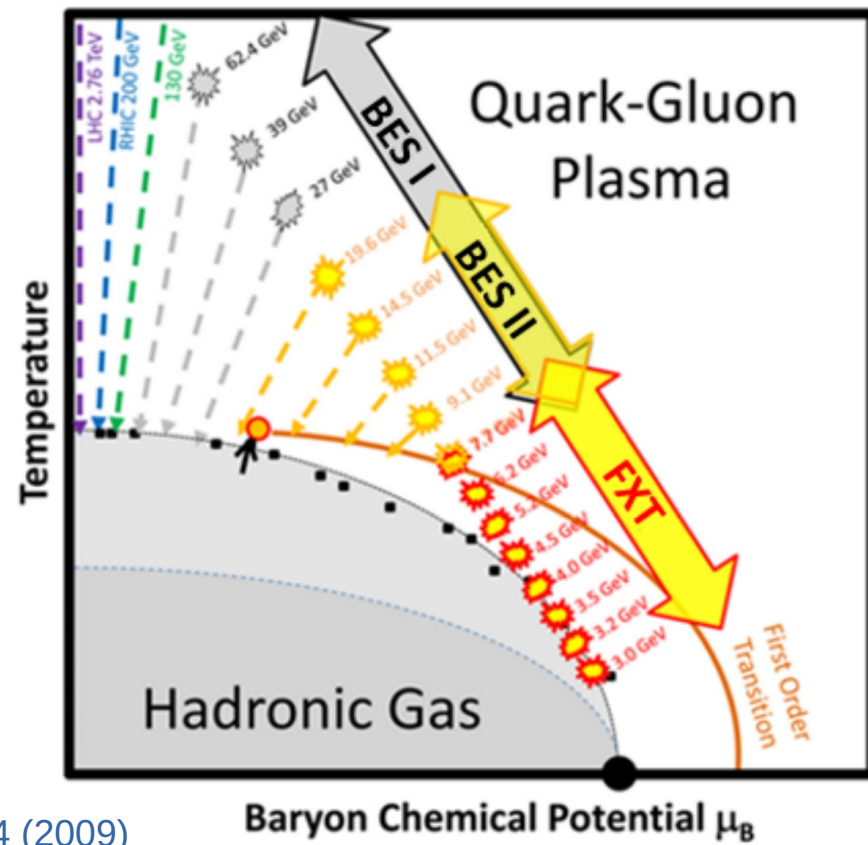


Benjamin Kimelman
University of California, Davis
For the STAR Collaboration



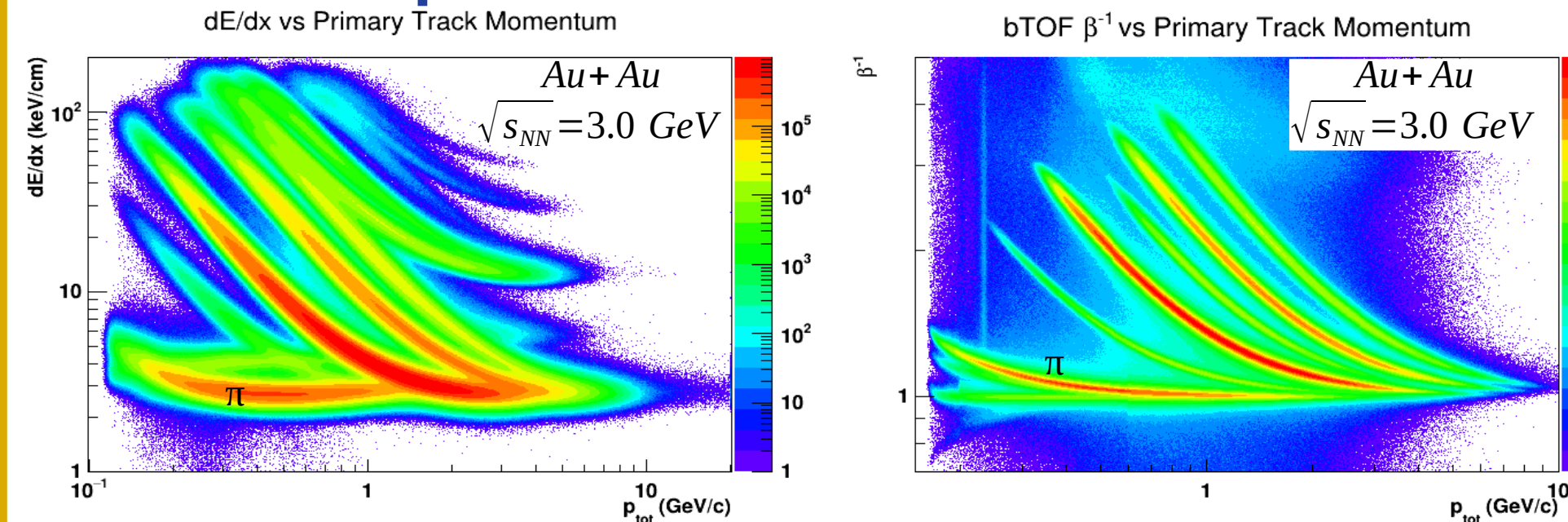
Motivation

Charged particle spectra can be used with a chemical equilibrium model to obtain thermal properties at chemical freeze-out^[1]. Pions can provide information about the Coulomb potential from the positive interaction region^[2].



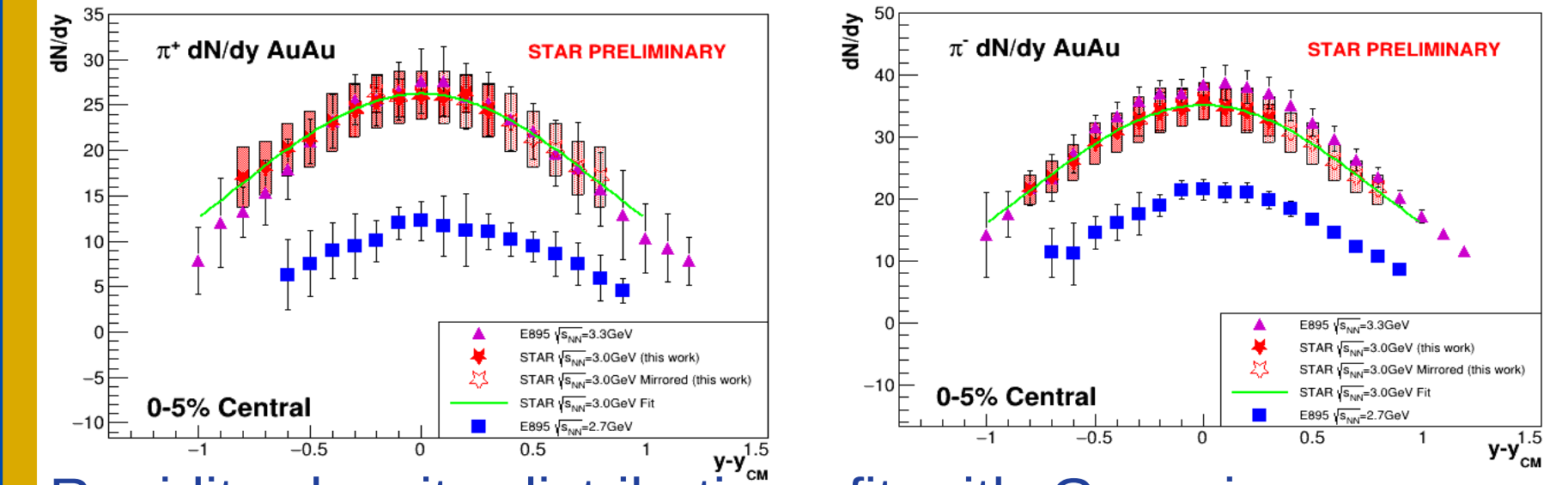
^[1]S. Wheaton et al., Comput. Phys. Commun. 180, 84 (2009)
^[2]D. Cebra et al., arXiv:1408.1369 [nucl-ex]

Spectra and Yield Extraction



For each charge, slices in two dimensions ($m_T - m_0$ and y) are taken of dE/dx and $1/\beta$. Resulting distributions are fit with Gaussians in order to extract the raw yields. Detector efficiency was estimated using a full simulation of the STAR detector to determine the response. Efficiency corrected data are then fit and integrated to obtain yields.

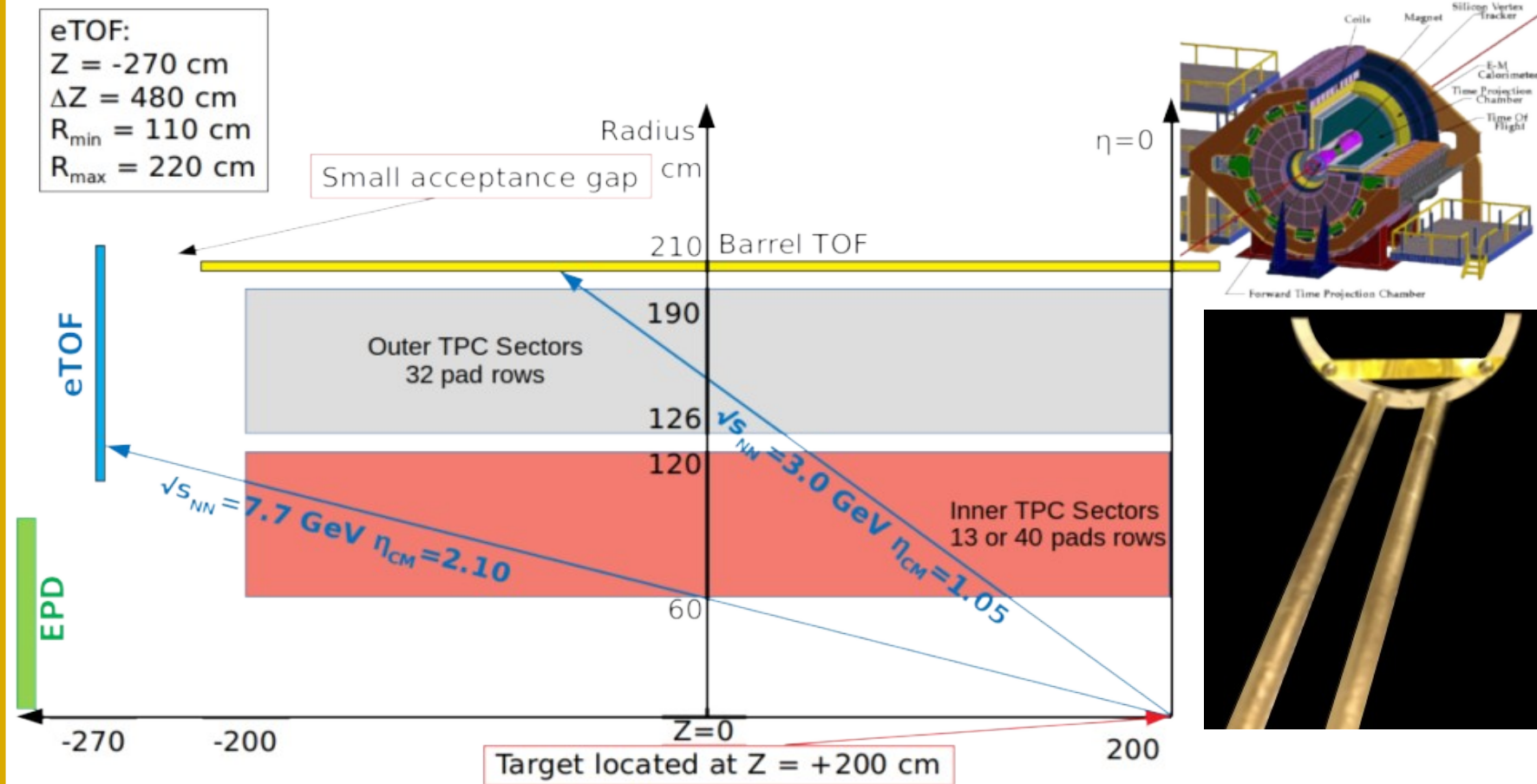
Pion Rapidity Density



Rapidity density distributions fit with Gaussians agree well with results from the E895 experiment^[1] at the AGS.

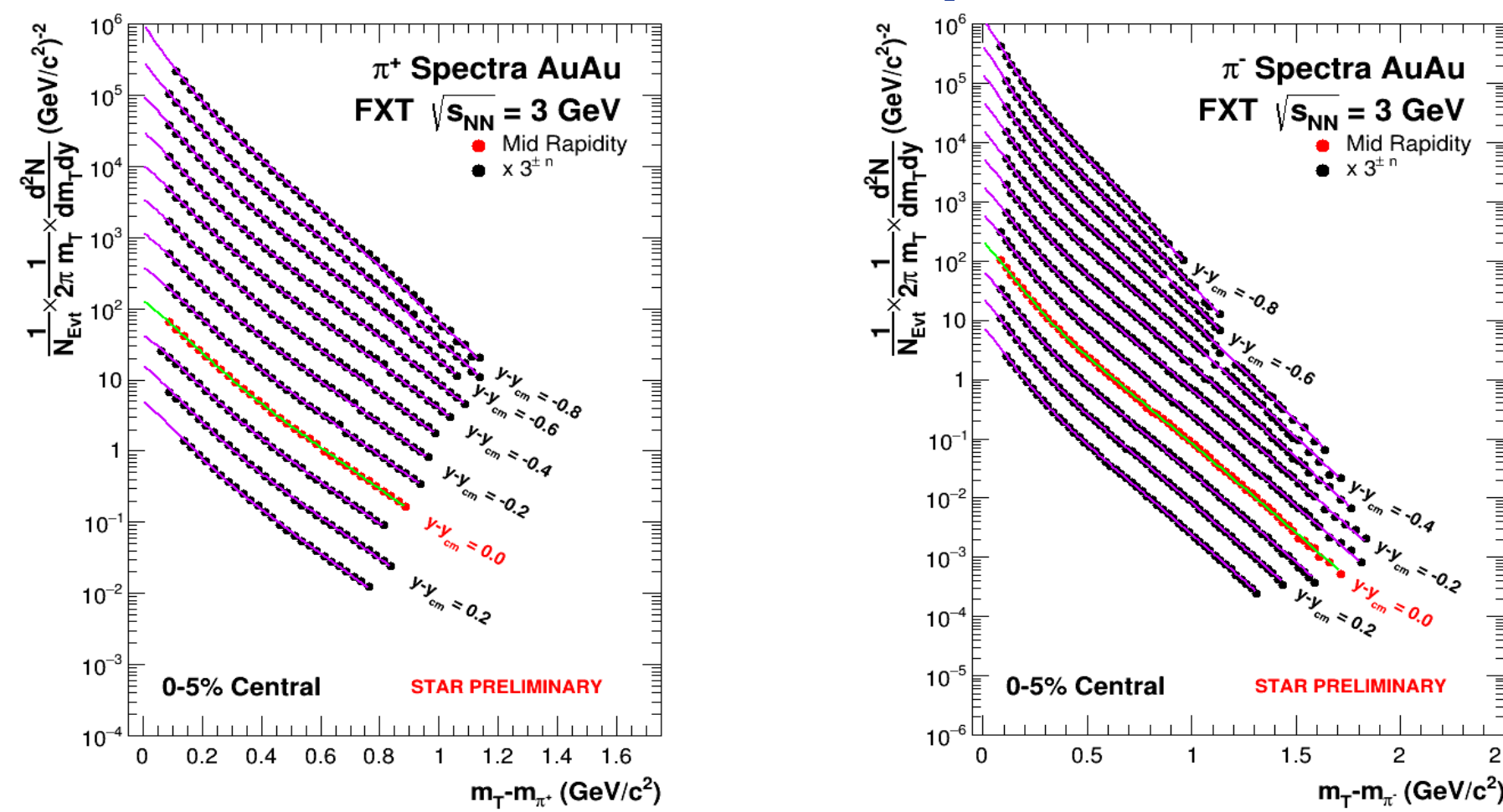
^[1]J. Klay et al. (E895 Collaboration), Phys. Rev. C 68, 054905 (2003)

The STAR Fixed-Target Program



Target first installed in 2015 with successful test run. Target is 0.25 mm thick (1% interaction probability) and held 2 cm below the center of the beam axis. When running in Fixed Target (FXT) mode, 12 bunches are used in the collider.

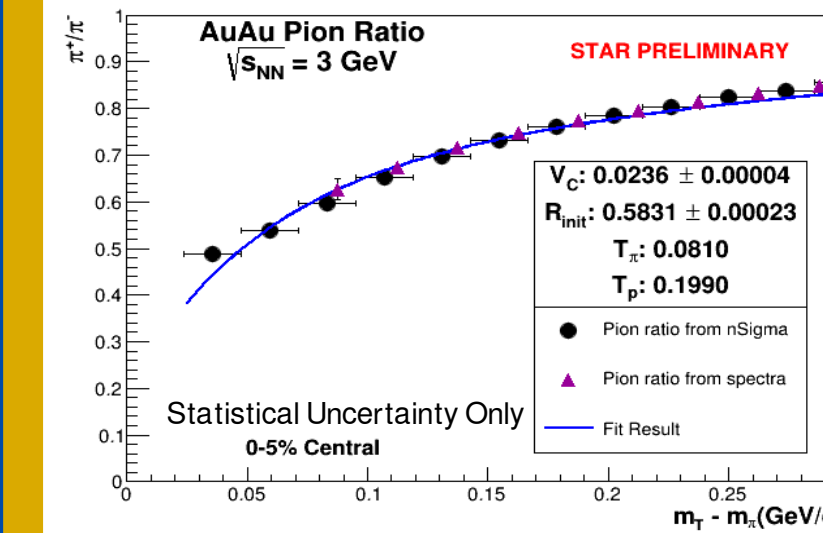
Pion Invariant Spectra



Pion spectra are fit with a double thermal function, which was shown by E895 to describe production from the Δ resonance at low temperature and thermal production at high temperature^[1].

^[1]J. Klay et al. (E895 Collaboration), Phys. Rev. C 68, 054905 (2003)

Coulomb Potential



Baryon stopping in low energy collisions results in a net positive charge in the interaction region. This modifies spectra of charged particles through the Coulomb potential, particularly pions which are light and produced copiously.

Conclusions and Outlook

The first results from the STAR Fixed-Target program have been shown to be consistent with and extend upon those from the AGS experiments at similar energies. The Coulomb potential of other FXT energies will be analyzed and added to global systematics.



Acknowledgments



This material is based upon work supported by the National Science Foundation under Grant No. 1812398 (Cebra and Calderón de la Barca). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily represent the views of the National Science Foundation.