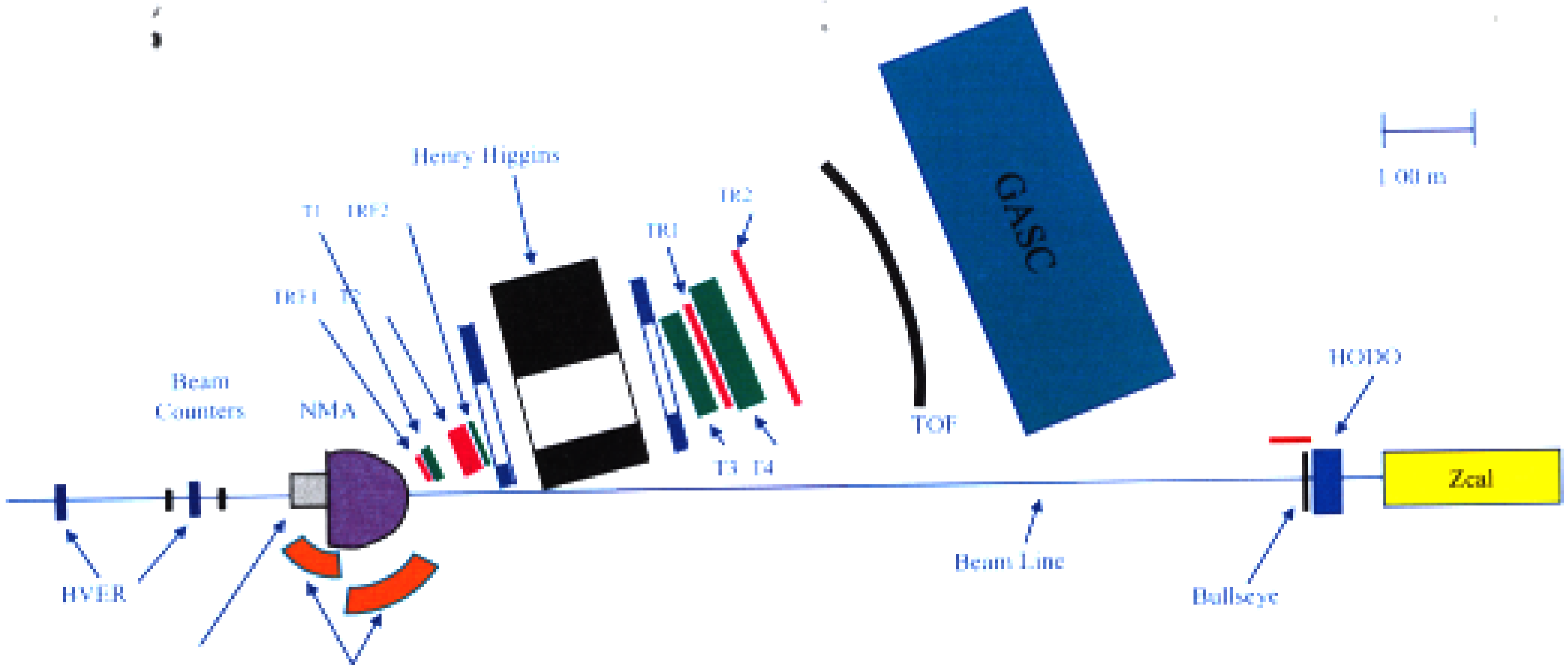
Systematic Study of Au-Au Collisions at the AGS by E917

Burt Holzman
University of Illinois at Chicago
for
the E917 Collaboration:

B. B. Back, R. R. Betts, Y. Y. Chu, J. Chang, W. C. Chang, C. Y. Chi, J. Cumming, J. C. Dunlop, W. Eldredge, S. Y. Fung, R. Ganz, E. Garcia, A. Gillitzer, G. Heintzelman, B. Holzman, J. H. Kang, E. J. Kim, S. Y. Kim, Y. Kwon, D. McLeod, **A. C. Mignerey**, M. Moulson, V. Nanal, C. A. Ogilvie, R. Pak, D. Russ, **R. Seto**, P. J. Stanskas, G. S. F. Stephans, A. Ruangma, H. Wang, F. L. H. Wolfs, A. H. Wuosmaa, H. Xiang, G. Xu, H. B. Yao, C. Zou

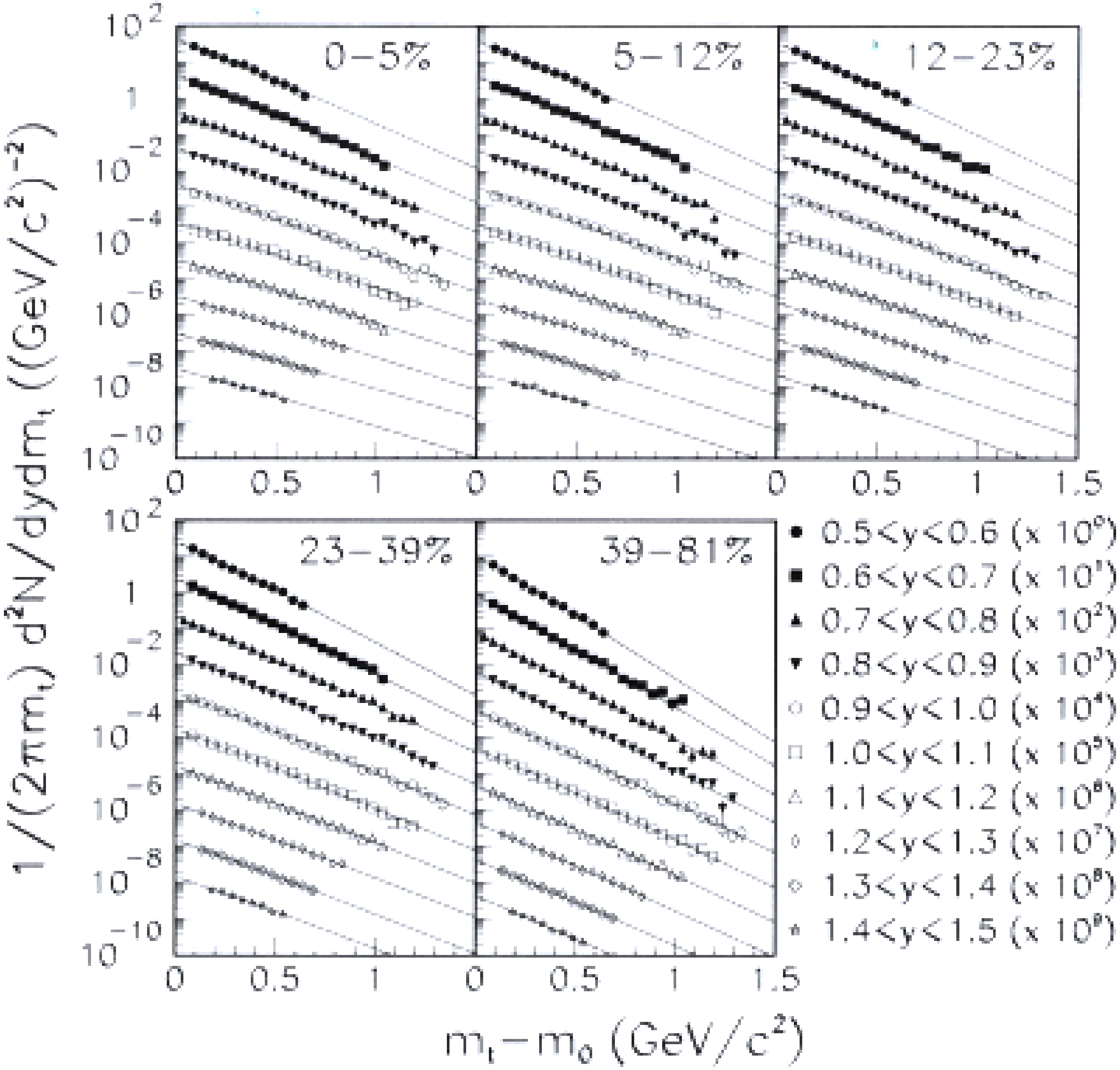
Argonne National Laboratory, Brookhaven National Laboratory, University of California at Riverside, Columbia University, University of Illinois at Chicago, University of Maryland, Massachusetts Institute of Technology, University of Rochester, Yonsei University (Korea)

E917 @ AGS: 6, 8, 10.8 AGeV



- Proton spectra and dN/dy distributions
- Antilambda/antiproton ratio vs. centrality
- Phi yield vs. kaon yield, number of participants

Proton m_t Spectra

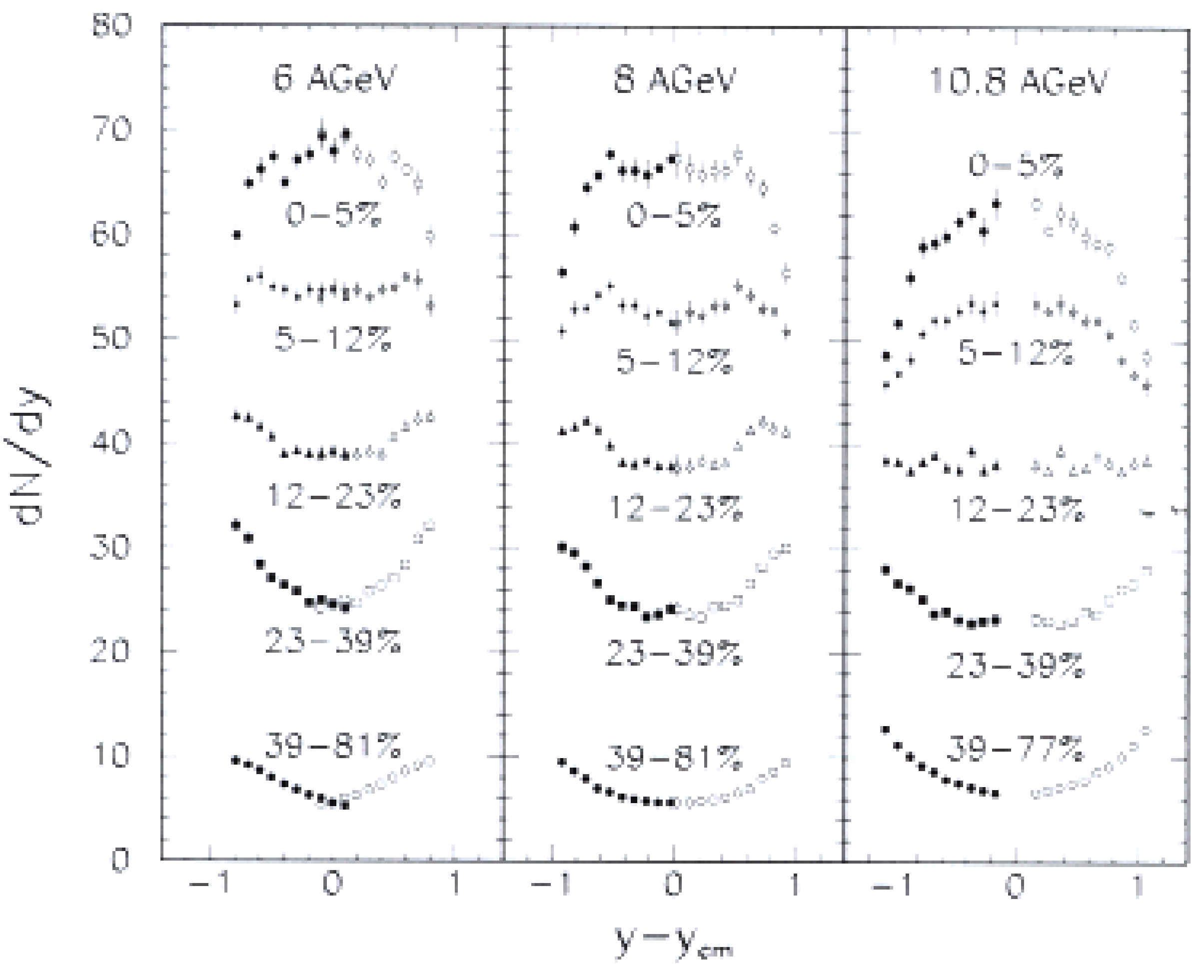


Typical transverse mass spectra @ 8 AGeV

All spectra fit to Boltzmann functions

Proton dN/dy Distributions

Protons originate almost exclusively from colliding nuclei; their spectra provide insight into collision dynamics



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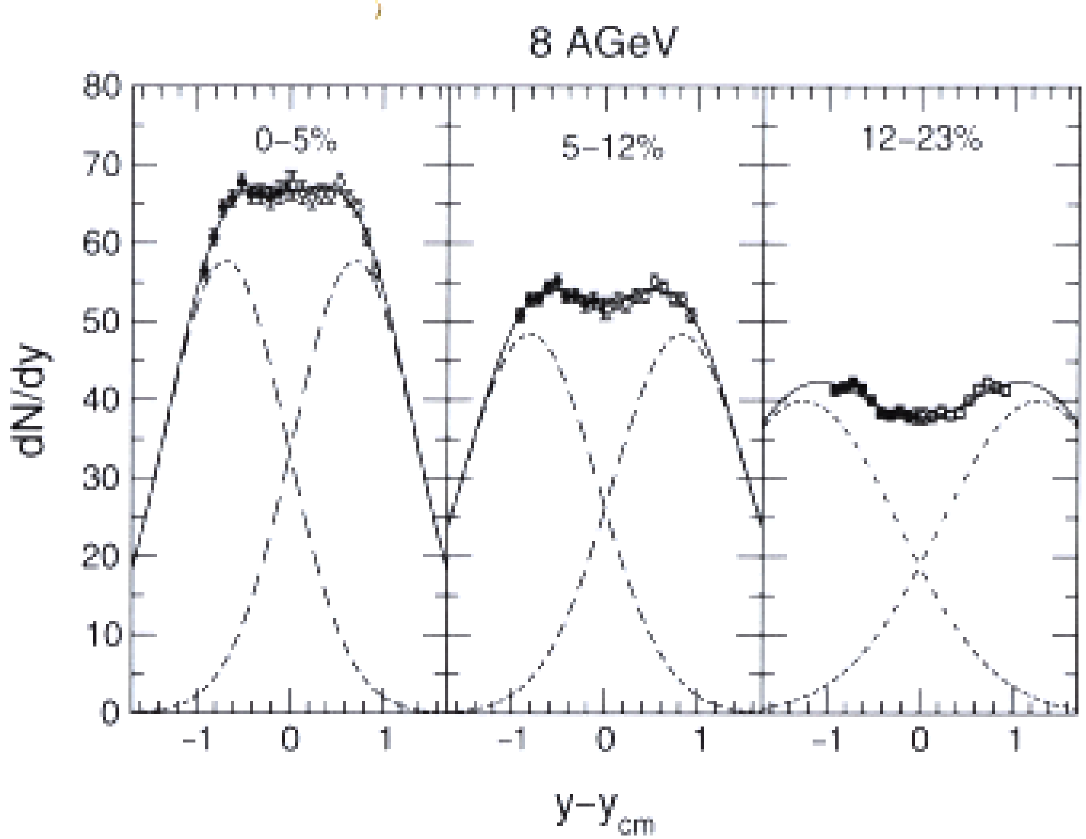
Proton dN/dy – Two-Gaussian Fit

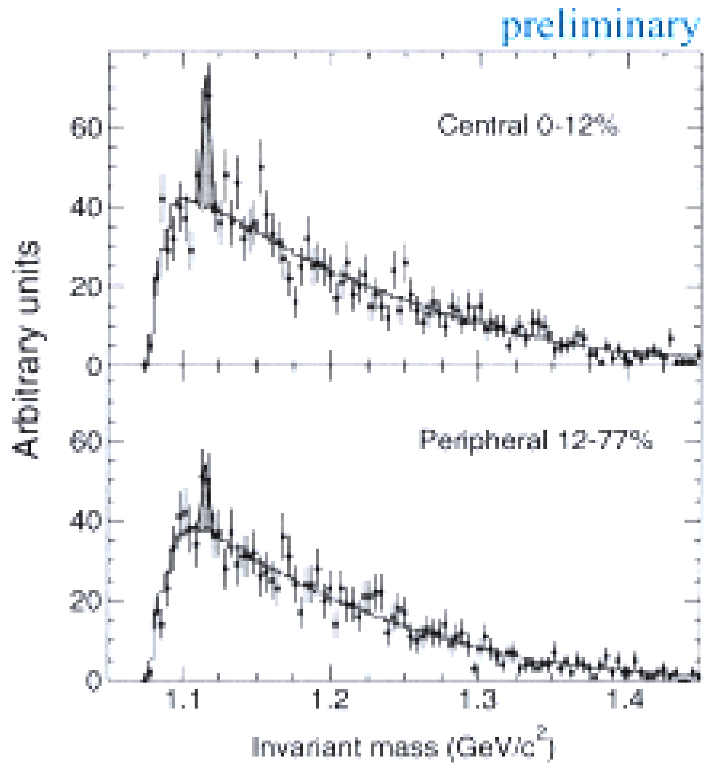


Distributions do not evolve to a single peak, but are consistent with bimodal distributions, even for the most central events

This suggests that complete stopping is not achieved at AGS energies and that the longitudinal rapidity distribution is a result of transparency

$\bar{\Lambda}/\bar{p}$ Invariant Mass, m_t Spectra

Ratio of strange to non-strange anti-baryons ($\bar{\Lambda}/\bar{p}$) reflect the relative abundance of $\bar{s}$ quarks to light anti-quarks.



Extracting the $\bar{\Lambda}$ yield:

- Determine experimental mass resolution by fitting Λ peak in the $p\pi^-$ invariant mass spectrum
- Opening angle cut of 15 msr applied to signal and background
- Normalize event-mixed background 6σ outside of peak
- Count up $\bar{p}\pi^+$ pairs within 3σ of peak and subtract background

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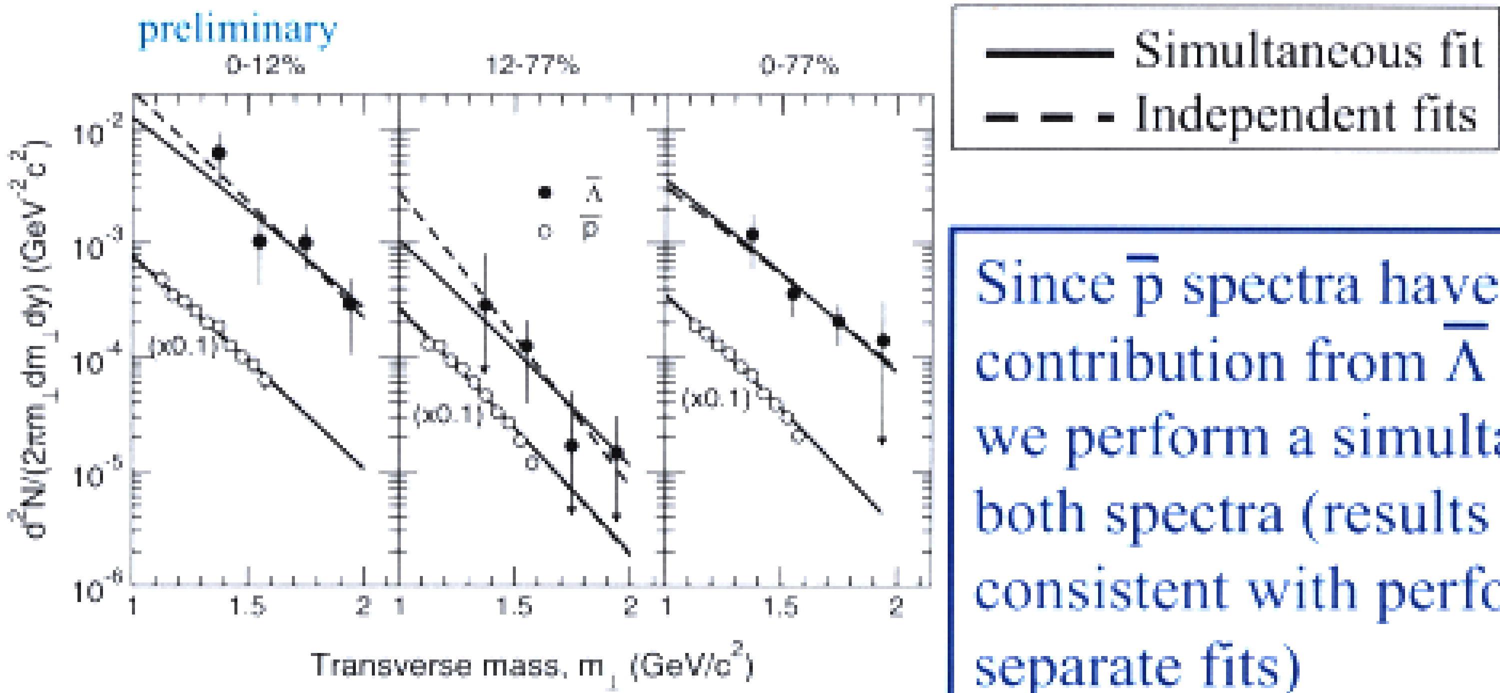
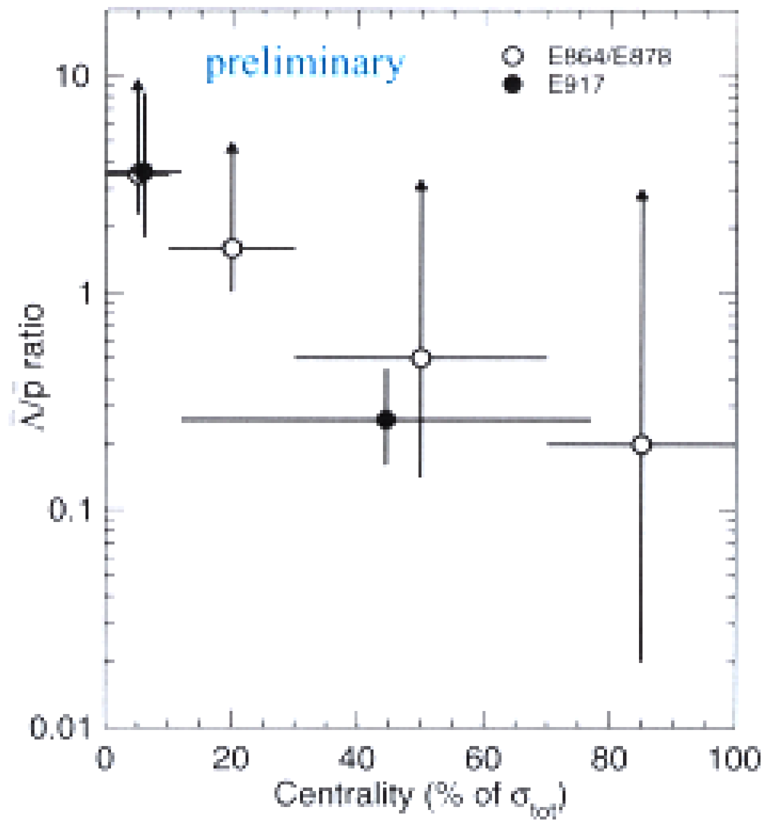


Rapidity range $1.2 \leq y \leq 1.6$

Since $\bar{p}$ spectra have a strong contribution from $\bar{\Lambda}$ decay, we perform a simultaneous fit to both spectra (results are consistent with performing separate fits)

$\bar{\Lambda}/\bar{p}$ Yield vs. Centrality

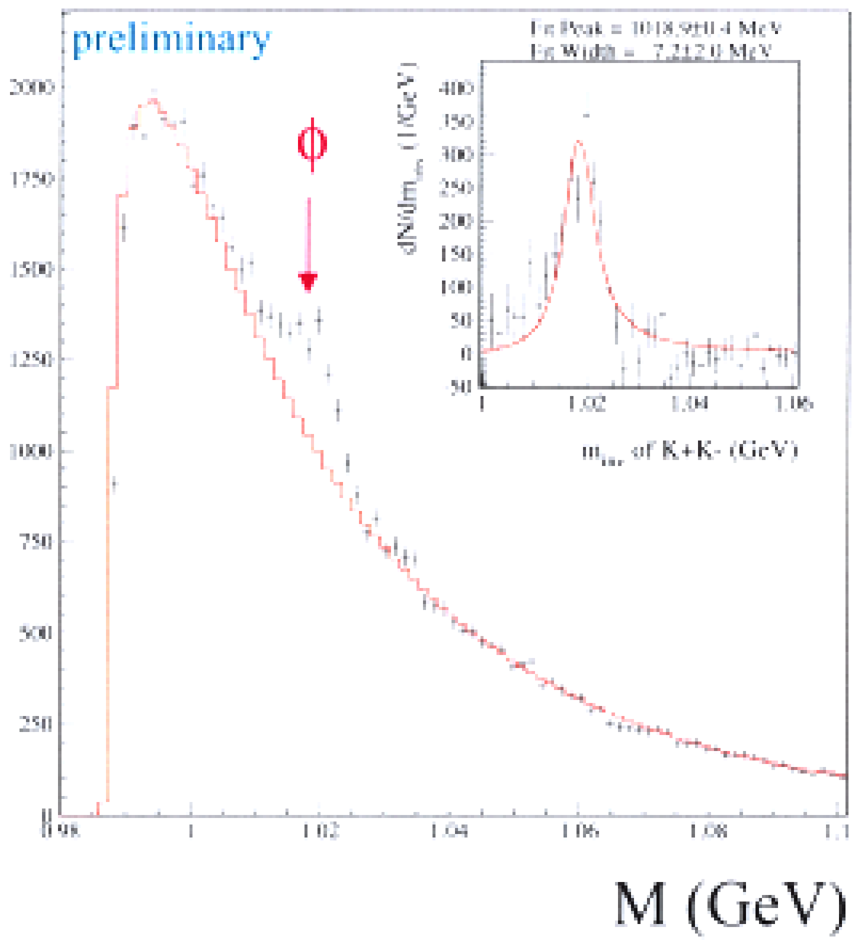


Centrality	$\bar{\Lambda}/\bar{p}_{direct}$
0-12%	$3.6^{+4.7\ +2.7}_{-1.8\ -1.1}$
12-77%	$.26^{+.19\ +.5}_{-.15\ -.4}$

Maximal values from theory:
UrQMD (F. Wang): ~ 1.3
Thermal (J. Cleymans) ~ .9

The ϕ Meson

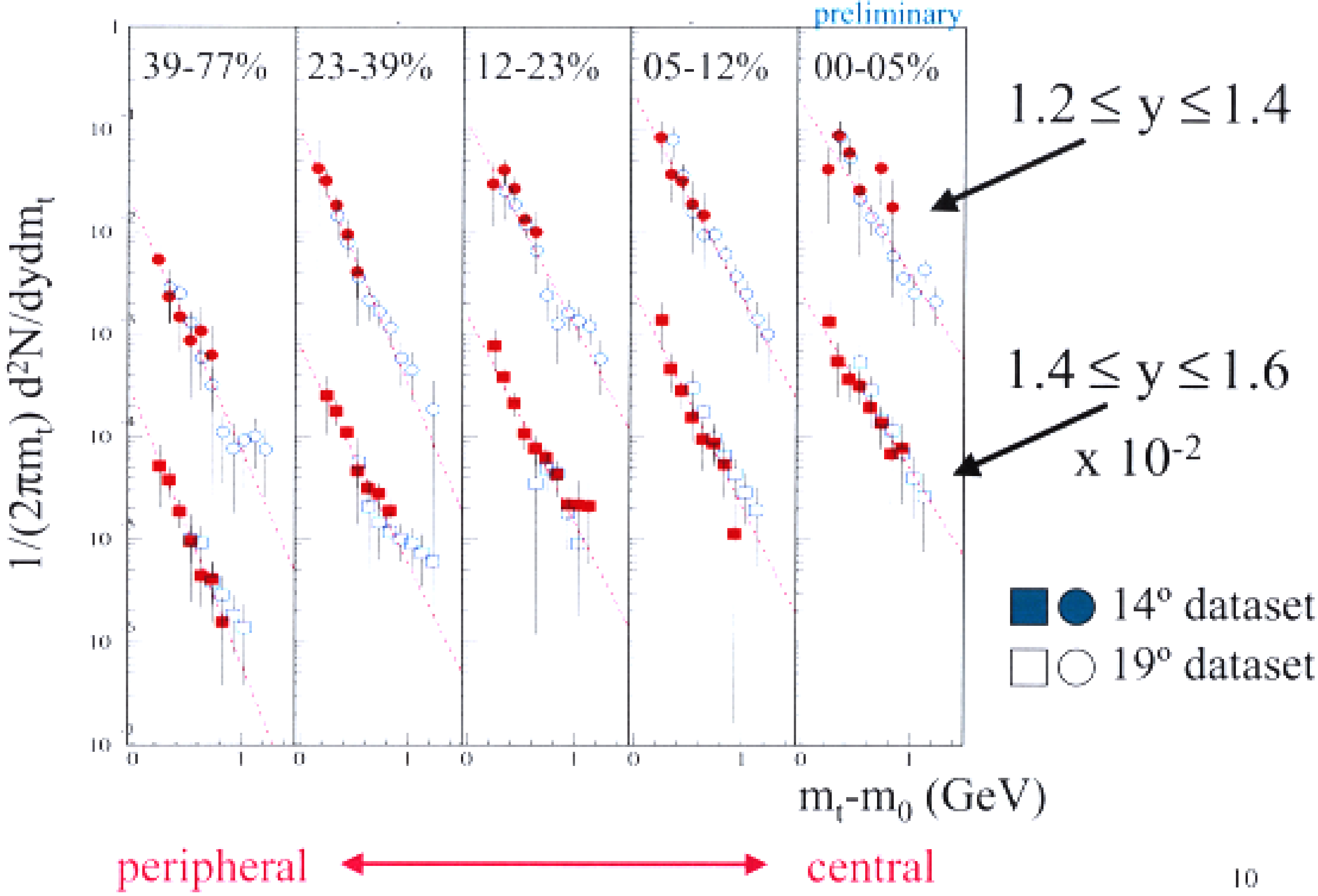
K^+K^- invariant mass



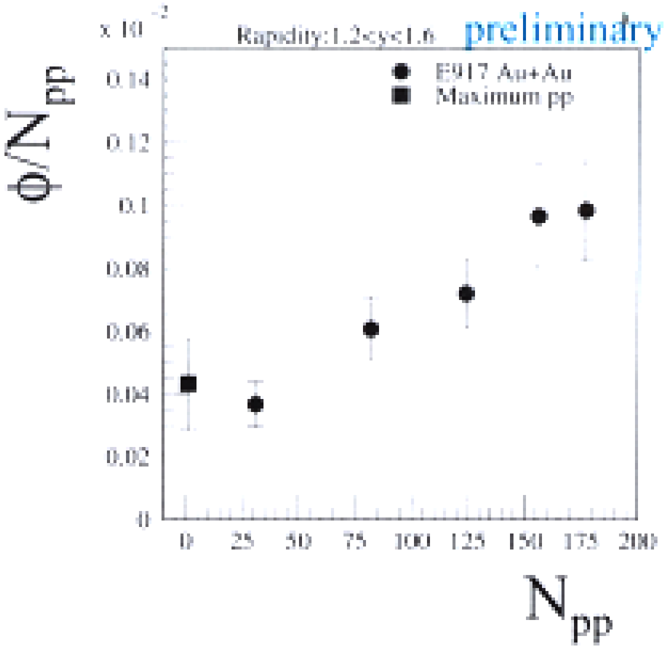
The ϕ meson is the lightest bound state of two strange quarks ($s\bar{s}$); it is therefore a probe of the strangeness produced in the reaction

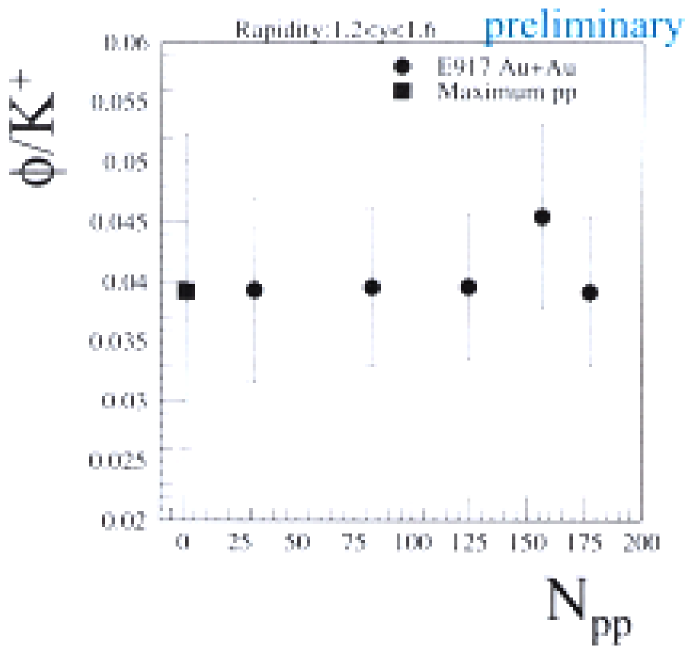
ϕ decays to K^+K^-; this decay mode may be sensitive to in-medium modifications of kaon properties

φ Transverse Mass Spectra



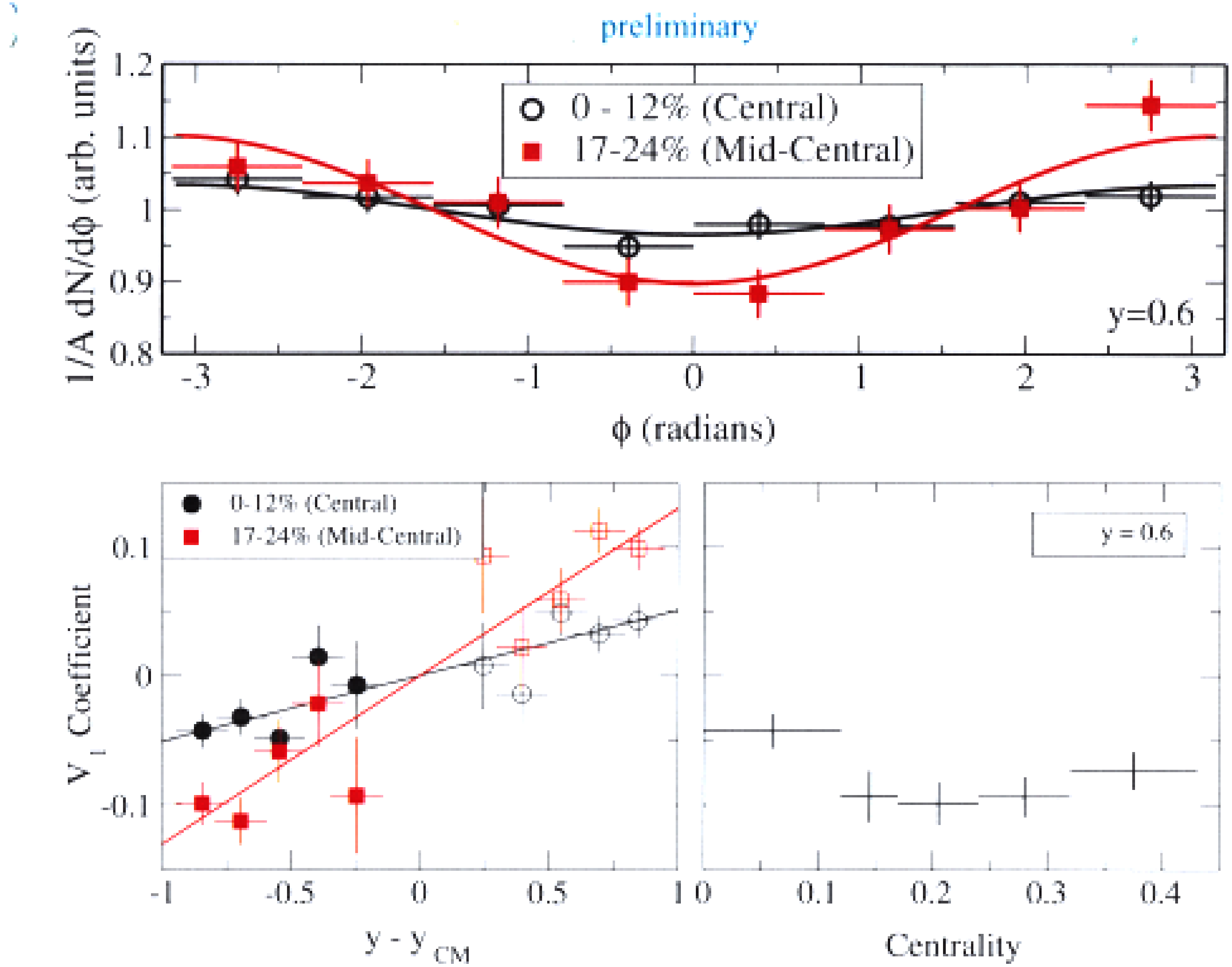
ϕ Yield vs. Centrality



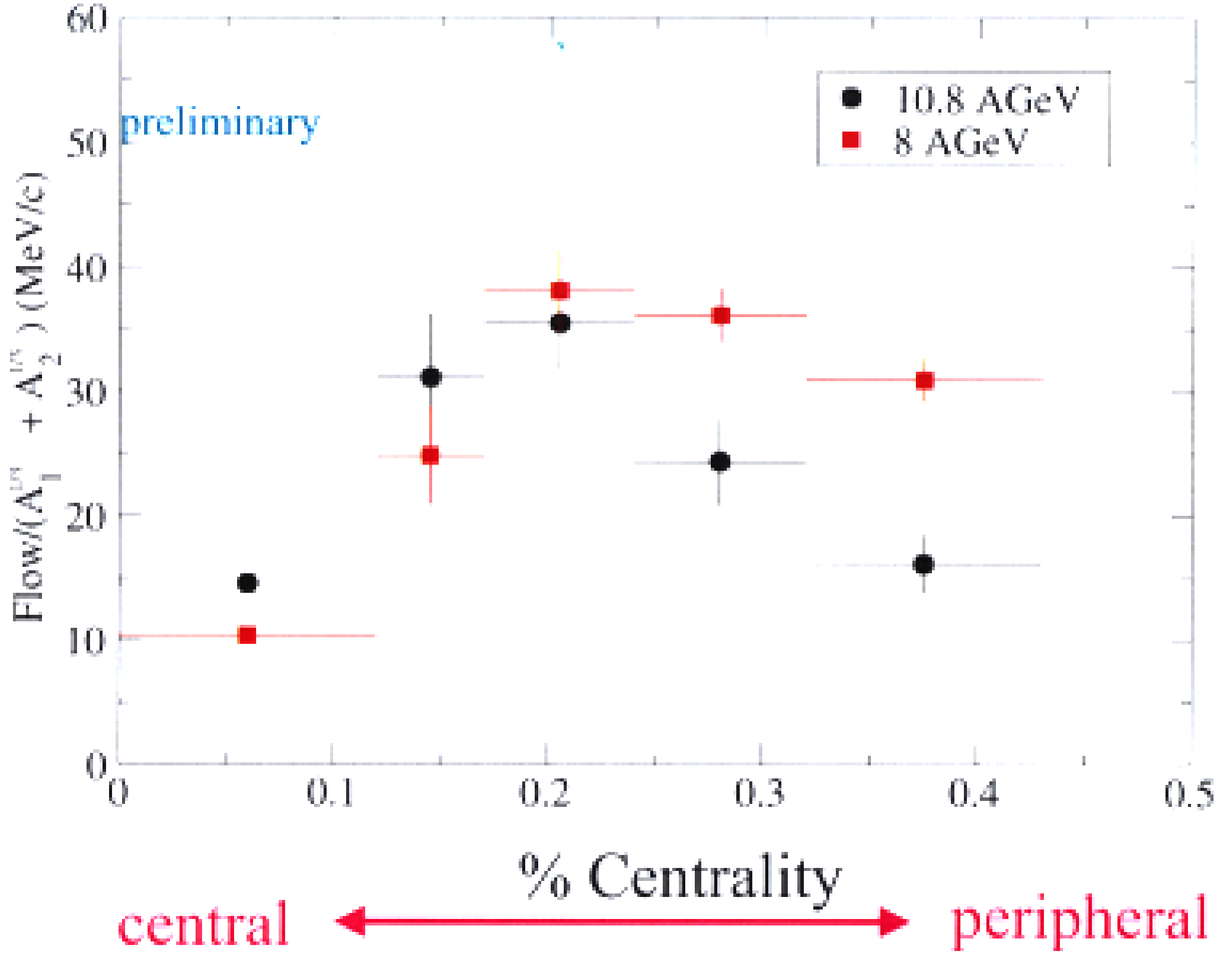


- ϕ/N_{pp} increases by a factor of 2.5 from peripheral towards central collisions: ϕ production more than superposition of individual nucleon-nucleon reactions
- ϕ/K^+ is independent of centrality

Proton Directed Flow – v_1



Proton Directed Flow – Mean p_x



Directed flow shows strong dependence on centrality; similar maxima at 8, 10.8 AGev

Conclusions

- Bimodal shape of proton dN/dy suggest incomplete stopping, transparency
- Strangeness production (K, ϕ) per participant increases with centrality, implying importance of secondary interactions in these processes
- First direct measurement of $\bar{\Lambda}/\bar{p}$ ratio: increases from .26 to 3.6 from peripheral to central collisions – a challenge for theory.
- We have studied proton directed flow, HBT with respect to the reaction plane