



High p_t Charged Pion Production
at
RHIC / PHENIX

Kenta Shigaki (KEK)

for the

PHENIX Collaboration

at

JPS Meeting at Niigata University

on

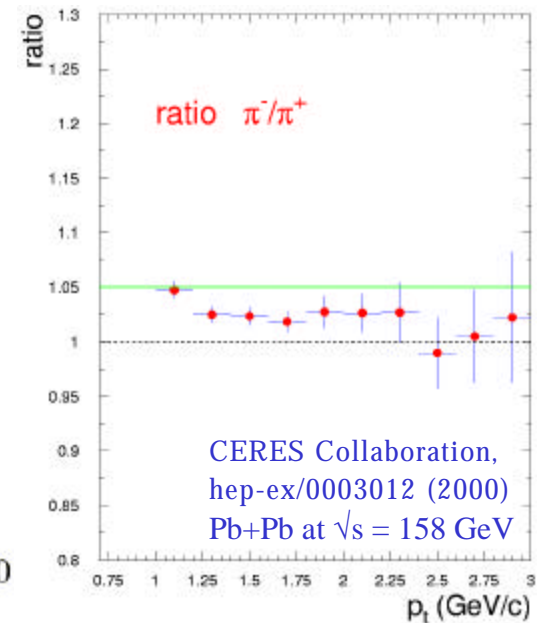
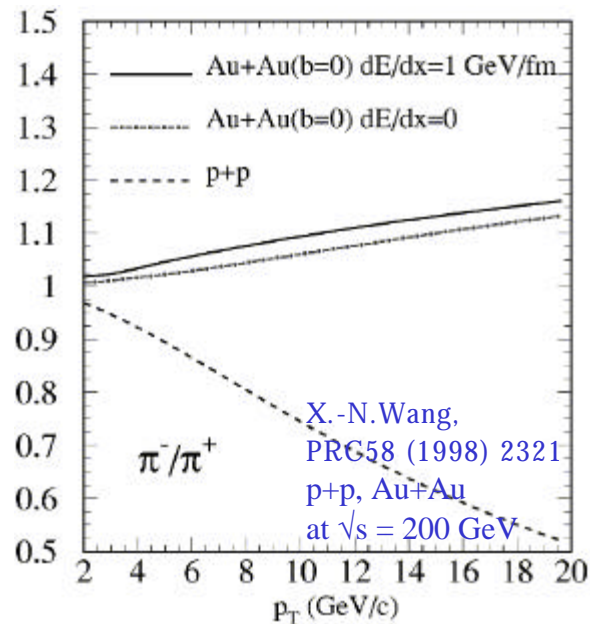
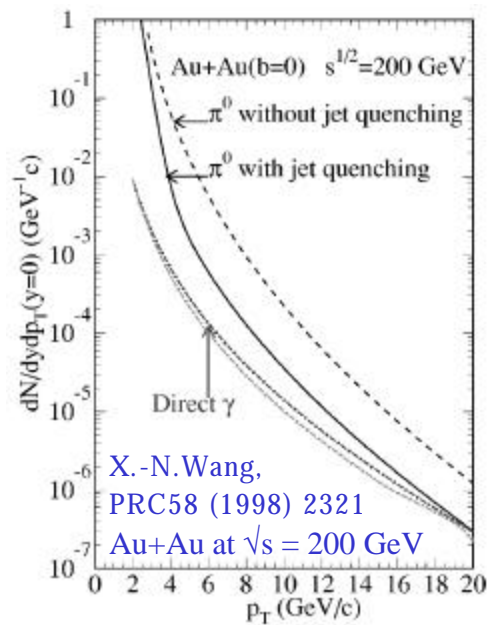
September 23, 2000

Presentation Outline

- Physics Goals and Approaches
- Run 2000 of PHENIX at RHIC
- PHENIX for Identified High p_t Charged Hadrons
 - Statistics in Run 2000
 - Momentum Resolution of PHENIX
 - Particle Identification Capability of PHENIX
- Ring Imaging Cherenkov Counter
 - Performance in Run 2000
- Summary and Conclusions

Physics Goals and Approaches

- quark energy loss (jet quenching)
 - high p_t tail of identified π^+ and π^- tracking + RICH
- quark fragmentation dominance
 - π^+/π^- ratio at high p_t tracking + RICH
 - K/π ratio at high p_t tracking + RICH + TOF



Run 2000 of PHENIX at RHIC

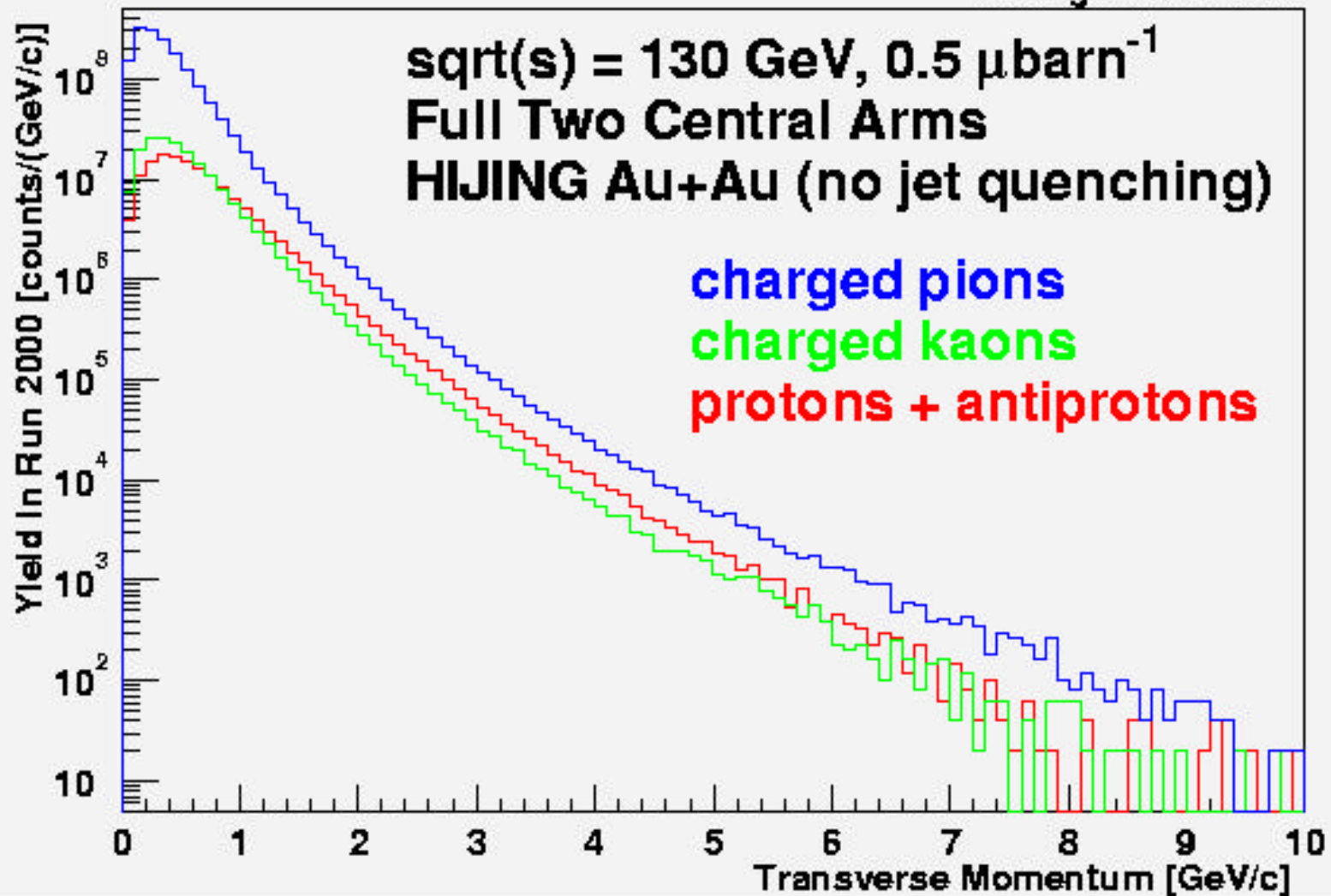
- first collision at PHENIX observed on June 15, 2000
- physics data taken in July through early-September, 2000
- run conditions
 - Au+Au at $\sqrt{s} = 56$ GeV and 130 GeV
 - recorded integrated luminosity $\sim 0.5 \mu\text{barn}^{-1}$
 - DC/PC1/RICH covering full 2 central arms
 - more detectors (TEC/PC3/TOF/EMCal) with limited coverage
- detector calibration / geometry alignment in progress
- tracking performance under study
- first round of mass DST production starting soon

Statistics in Run 2000

- HIJING generator employed here
 - statistical limit $\sim 7.5 \text{ GeV}/c$
 - $\sim 10^2$ counts per GeV/c per charge state at $p_t \sim 7.5 \text{ GeV}/c$ without jet quenching
 - factor ~ 4 suppression in the p_t region with jet quenching
 - jet quenching should be clearly observable

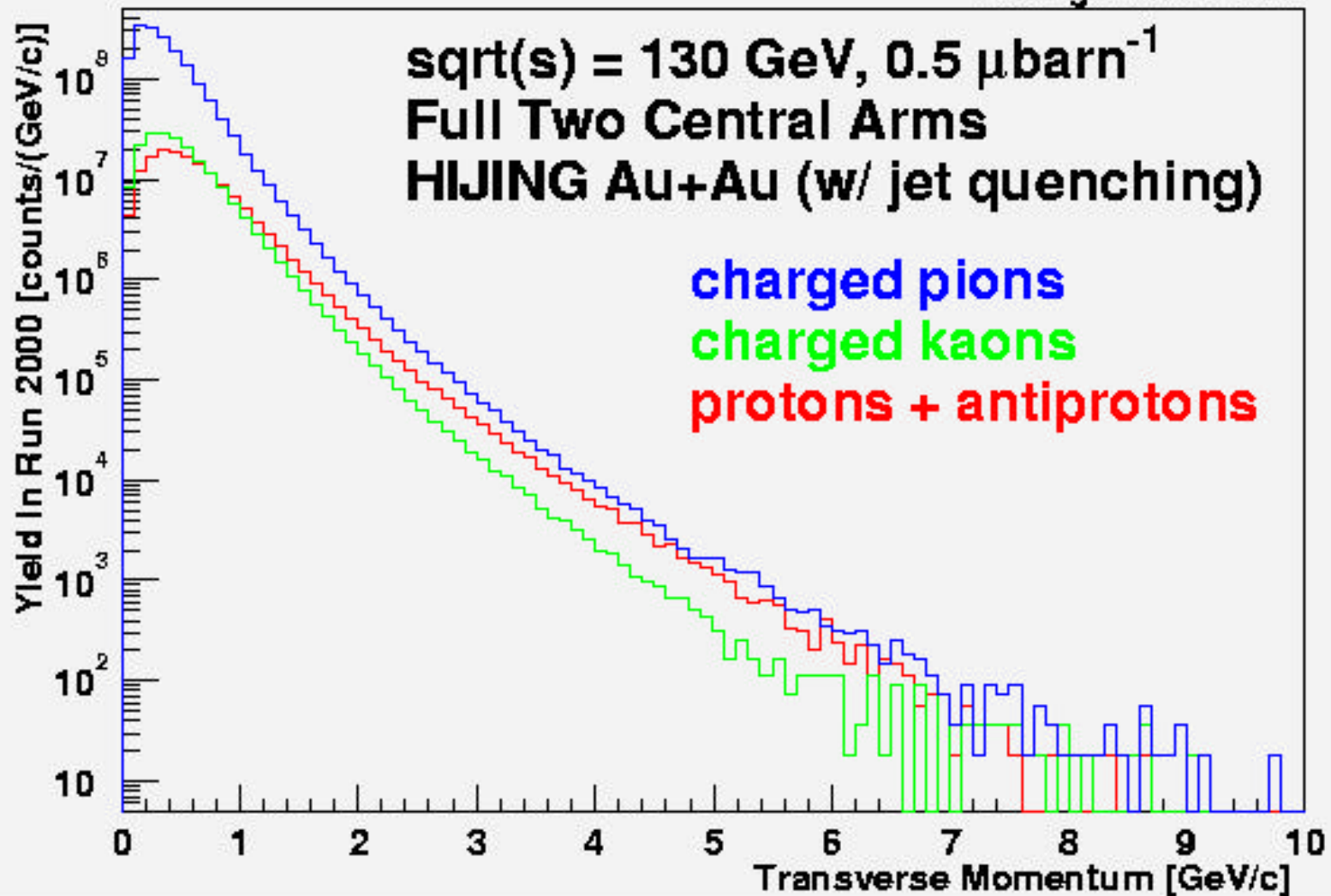
Charged Particle Yield in PHENIX Run 2000

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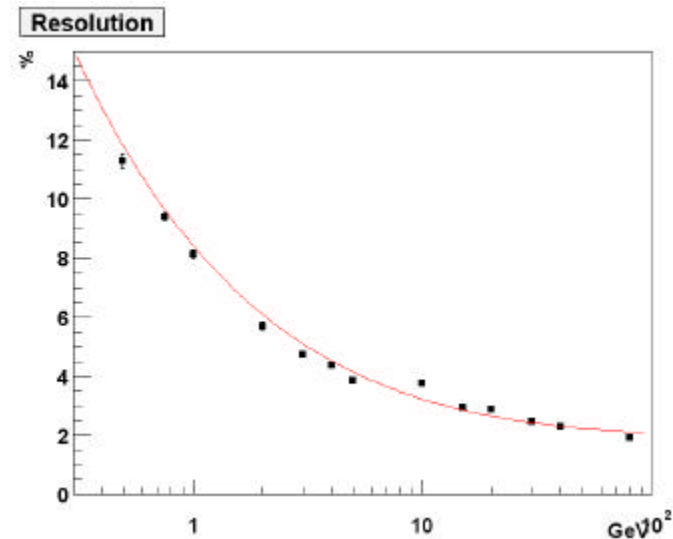
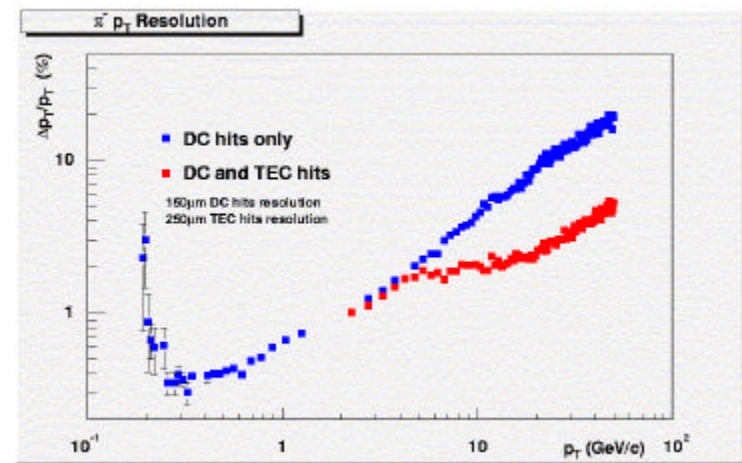
Charged Particle Yield in PHENIX Run 2000

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Momentum Resolution of PHENIX

- track momentum resolution
 - simulation study with DC only by J.Lajoie
 - 2 % at $p_t = 5 \text{ GeV}/c$
 - 4.5 % at $10 \text{ GeV}/c$
- *cf.* EMCal resolution for π^0
 - beam test analysis by A.Bazilevsky and H.Torii
 - 1.9 % \oplus 8.2 % / \sqrt{E}
 - 4 % for π^0 at 5 GeV
 - 3 % at 10 GeV
 - real data analysis in progress
 - *cf.* talks by H.Torii and K.Oyama

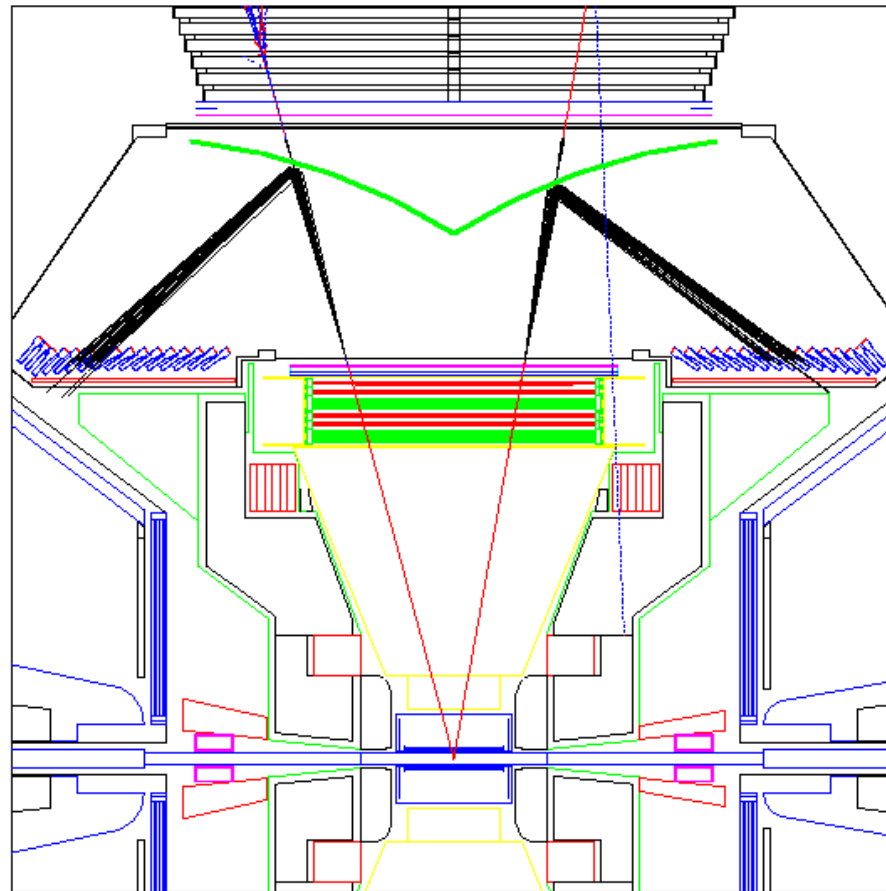


PID Capability of PHENIX

- RICH with CO₂ in runs 2000 and 2001
 - $\gamma_{\text{th}} = 33$
 - π threshold = 4.7 GeV/c
 - effective π ID above ~ 5.5 GeV/c
 - π ID requirements much less stringent compared to eID
- time-of-flight wall
 - design time resolution ~ 80 psec
 - *cf. talk by A.Kiyomichi*
 - p/K track-by-track (4σ) separation up to 4.0 GeV/c
 - p/K separation of 2σ at 6.0 GeV/c; yields accessible via multi-parameter fitting
 - p_t window for p/K/ π yields

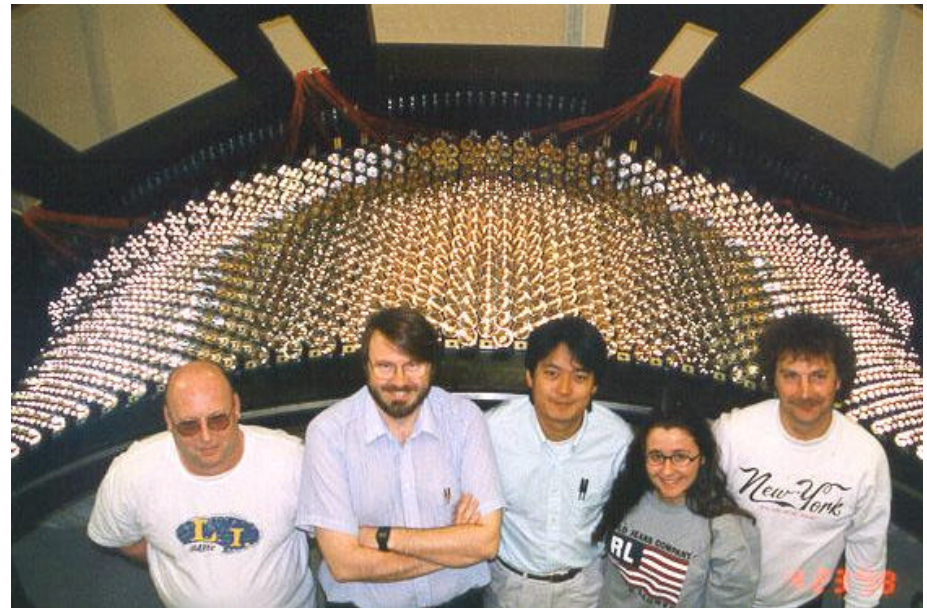
Ring Imaging Cherenkov Counter

- primary electron identification device of PHENIX
 - gaseous radiator
 - PMT array readout
 - hadron rejection at 10^4 level up to π threshold



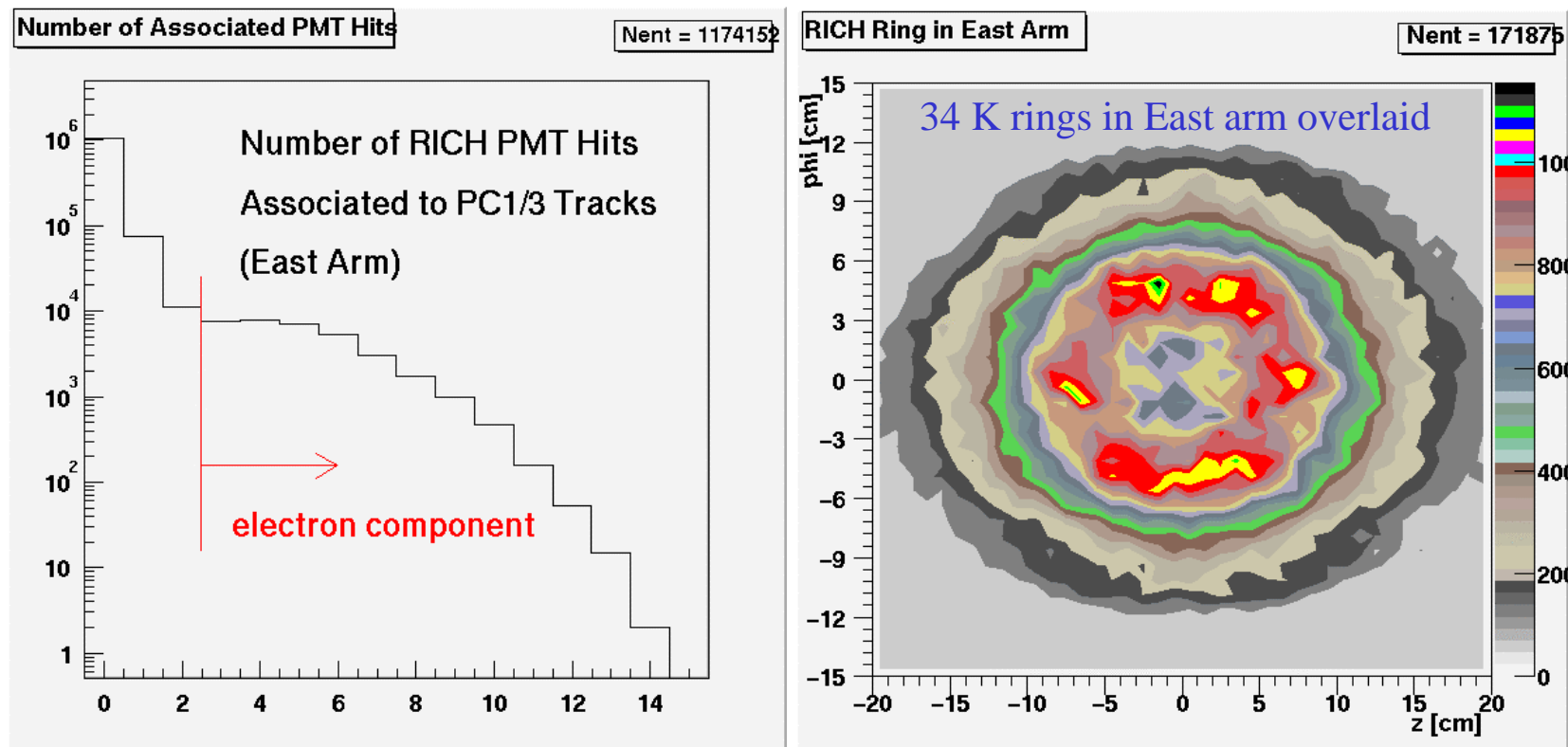
Ring Imaging Cherenkov Counter

- RICH physicists and graduate students (as of run 2000)
 - CNS, U.Tokyo
H.Hamagaki, T.Matsumoto,
K.Oyama, T.Sakaguchi
 - Florida State U.
A.D.Frawley
 - KEK
Y.Akiba, S.Sawada, K.Shigaki
 - Nagasaki Inst. of Appl. Science
M.Fukutomi, Y.Nagasaka,
Y.Tanaka, T.Ushiroda
 - State U. of NY at Stony Brook
T.K.Hemmick
 - Waseda U.
S.Kametani, J.Kikuchi, M.Tamai



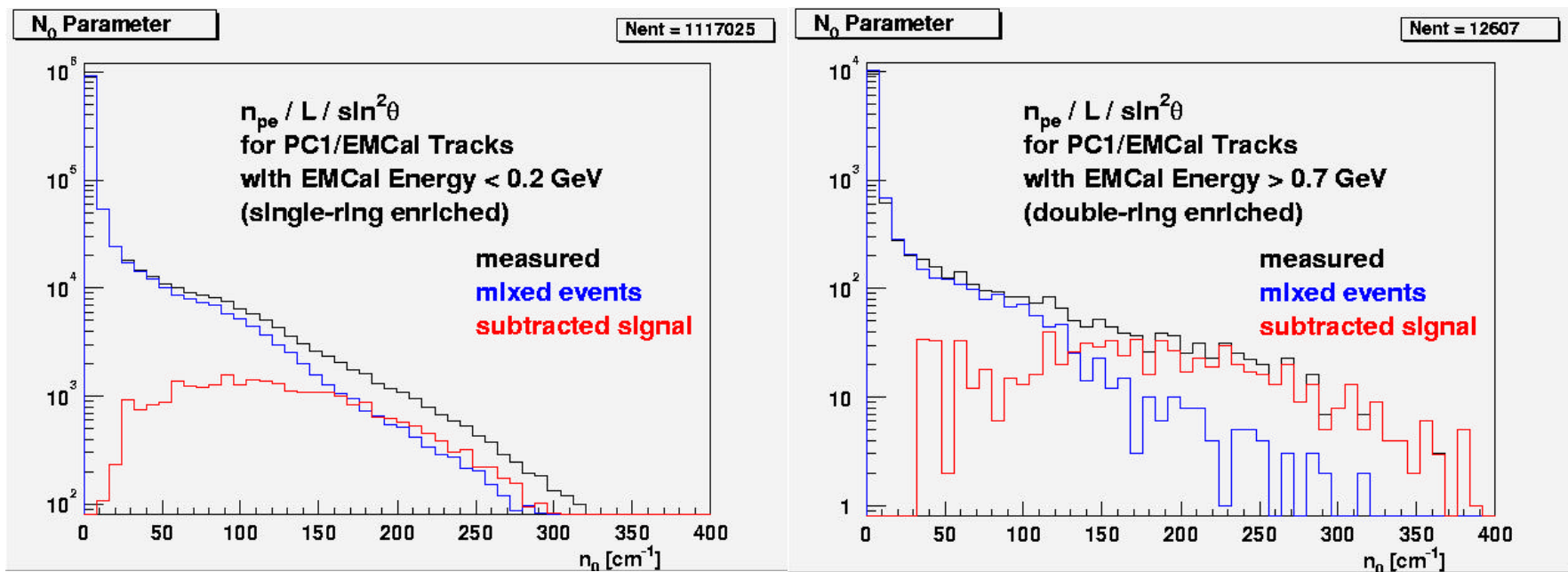
RICH Performance in Run 2000

- electron and hadron components separated
- clear Cherenkov rings associated to charged particle tracks



RICH Performance in Run 2000

- n_0 parameter ($n_{pe} = n_0 L \sin^2\theta$) ~ design value
 - $n_0 \sim 100 \text{ cm}^{-1}$ in beam test of prototype
 - evaluated using zero field data
 - single- and double-ring enriched samples by energy in EMCAL



Summary and Conclusions

- PHENIX successfully completed first physics run
- physics via high p_t charged pions to be extracted
 - tracking (DC/PC1) and RICH cover full 2 central arms
 - p_t range from $\sim 5.5 \text{ GeV}/c$ to $\sim 7.5 \text{ GeV}/c$ in run 2000
 - jet quenching should be clearly observable
- $p/K/\pi$ ratio can be measured in a small p_t window
 - tracking + RICH + TOF
 - p_t range from $\sim 5.5 \text{ GeV}/c$ to $\sim 6.0 \text{ GeV}/c$
- detector calibration and physics analysis in progress
 - tracking performance under study
 - RICH performing well
 - electron and hadron components separated
 - clear Cherenkov rings associated to charged particle tracks
 - n_0 parameter probably $\sim 100 \text{ cm}^{-1}$
 - high statistics analysis starting soon