The STAR Experiment at RHIC

Thomas Ullrich for the STAR Collaboration

- The STAR experiment
- Show and Tell: First collisions
- Detector performance and Trigger
- Status of Data Analysis
- Outlook

ICHEP, Osaka, Japan
July 27, 2000

Yale University

The STAR Collaboration

U.S. Labs:

Argonne, Berkeley, and Brookhaven National Labs

U.S. Universities:

Arkansas, UC Berkeley, UC Davis, UCLA, Carnegie Mellon, Creighton, Indiana, Kent State, MSU, CCNY, Ohio State, Penn State, Purdue, Rice, Texas A&M, UT Austin, Washington, Wayne State, Yale

Brazil:

Universidade de Sao Paolo

China:

IHEP - Beijing, IPP - Wuhan

England:

University of Birmingham

France:

Institut de Recherches Subatomiques Strasbourg, SUBATECH - Nantes

Germany:

Max Planck Institute – Munich
University of Frankfurt

Poland:

Warsaw University, Warsaw University of Technology

Russia:

MEPHI – Moscow, LPP/LHE JINR – Dubna, IHEP - Protvino

Institutions: 36, Collaborators: 415, Spokesperson: John Harris

The STAR Collaboration

RHIC @ Brookhaven National Laboratory

STAR Physics Program

Relativistic Heavy Ion Physics

High Density QCD Matter

QCD Deconfinement Phase Transition

Chiral Phase Transition

Polarized Proton-Proton Interactions

Spin Structure of the Nucleon

2-Photon Physics

Intense EM Fields of Passing Nuclei

→Coherent Source of γ's

Investigate the Plethora of Particles in 1 - 2 GeV Mass Range

(cannot be fit by QCD)

STAR RHI Physics Program

Initial Conditions

Nuclear (q and g) structure functions, nuclear shadowing

PQCD Probes

Parton (jet, mini-jet, high Pt particle) propagation/attenuation in matter

High Pt spectra (gluon versus quark jet production)

EM Probes

Virtual photons (e+e-)

Probes of Deconfinement

J/P suppression (e+e-)

Flavor equilibrium (strangeness saturation, multiply-strange baryons)

Critical (non-statistical, dynamical) fluctuations

Probes of Chiral Restoration

Resonance widths, masses, and branching ratios

Isospin fluctuations, disoriented chiral condensates (charge to neutral ratios)

Kinematic Probes

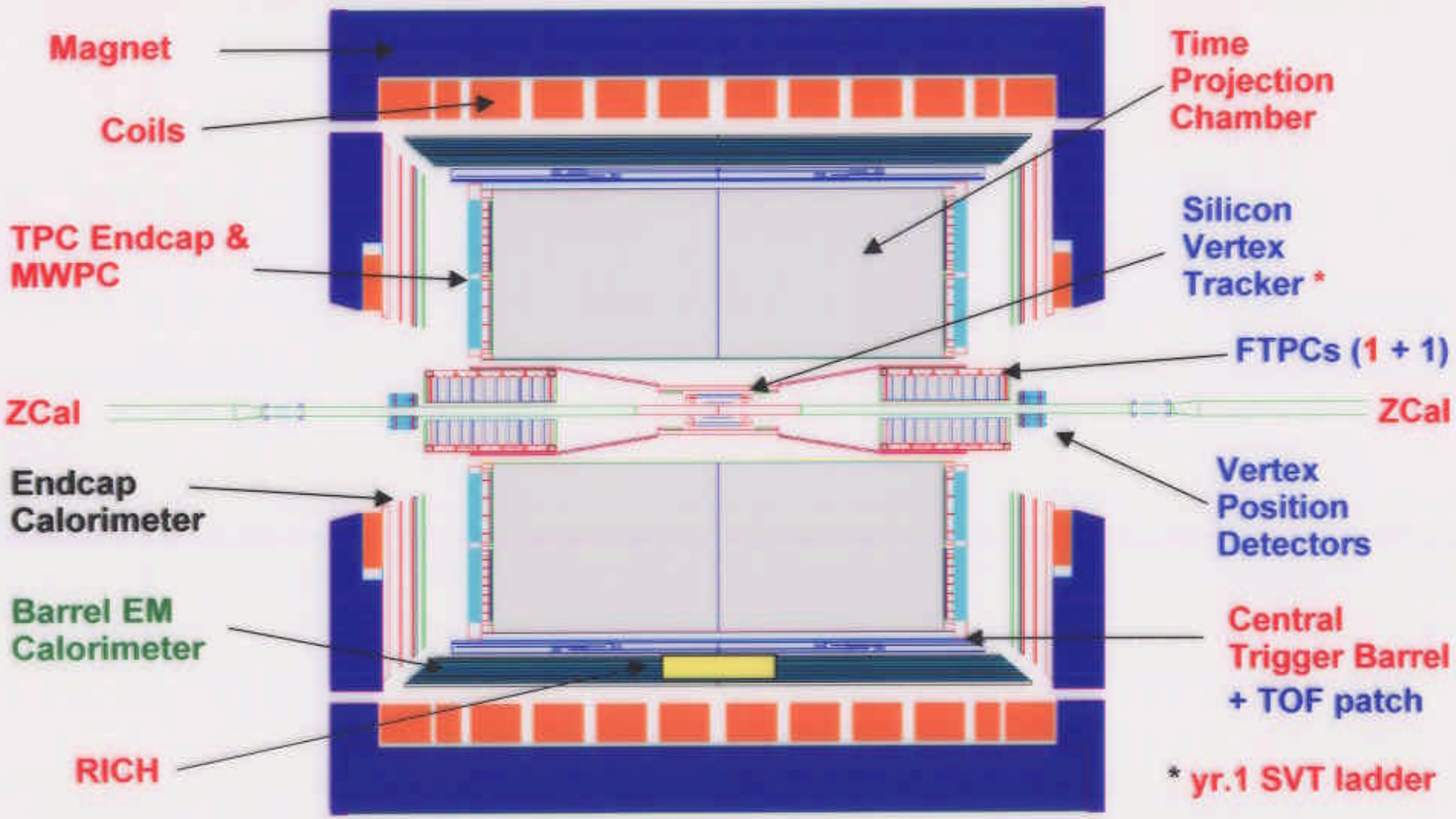
Hadronic spectra (y, Pt) - thermalization (T, m_B, s, m_s, …) and freeze-out

HBT - space-time evolution (possible phase change)

E-by-E (Pt, HBT, collective flow, strangeness content - i.e. T, m_B, s, m_s, …)

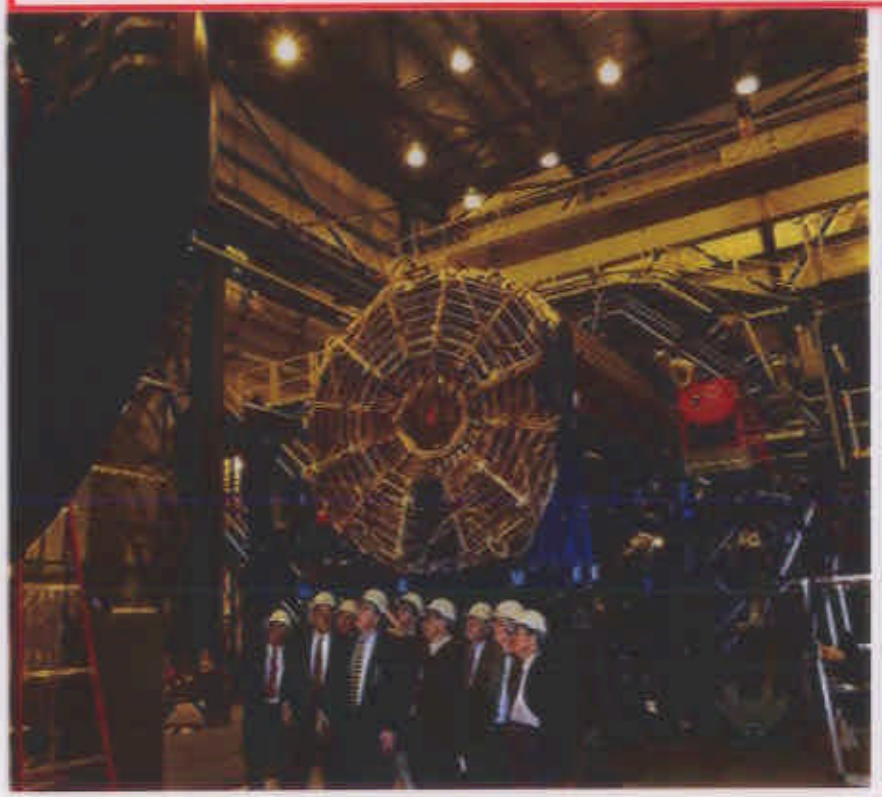
Anti-baryons, anti-nuclei

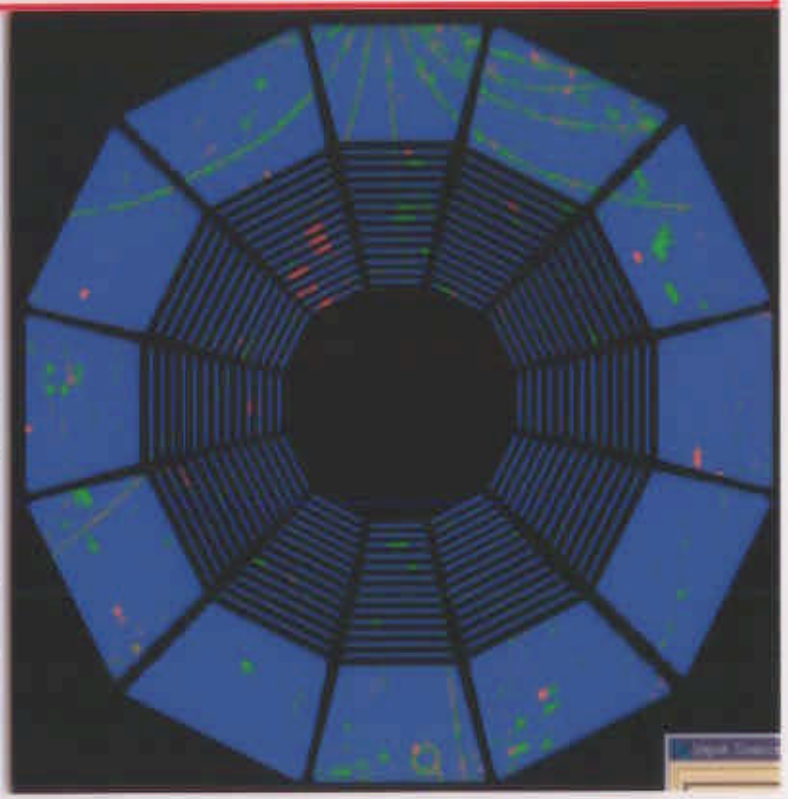
The STAR Detector (year-by-year)



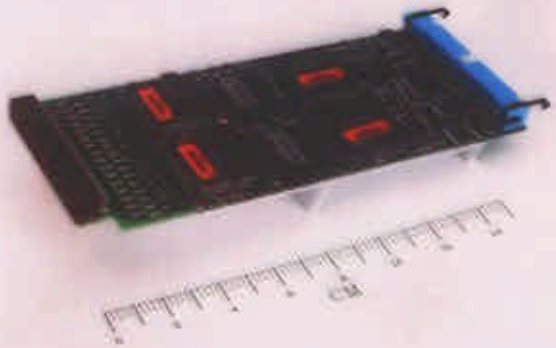
1st year, 2nd year, year-by-year until 2003, installation in 2003

The STAR TPC





On-board FEE Card: Amplifies, samples, digitizes 32 channels



Active volume: Cylinder r=2 m, l=4 m

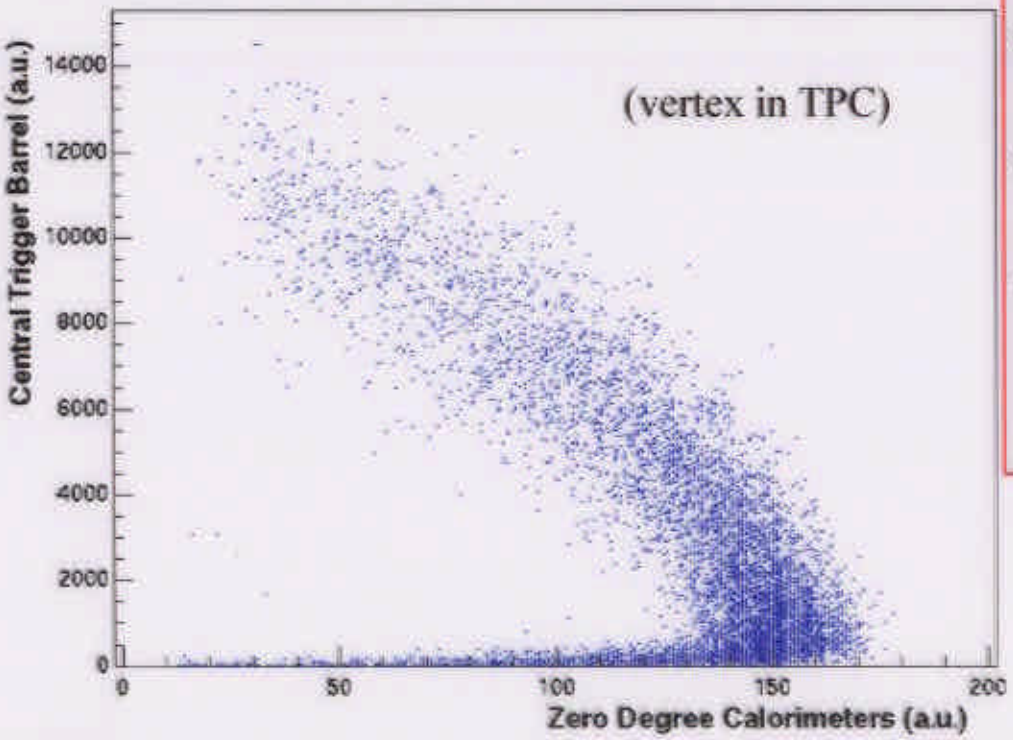
- 139,000 electronics channels sampling drift in 512 time buckets

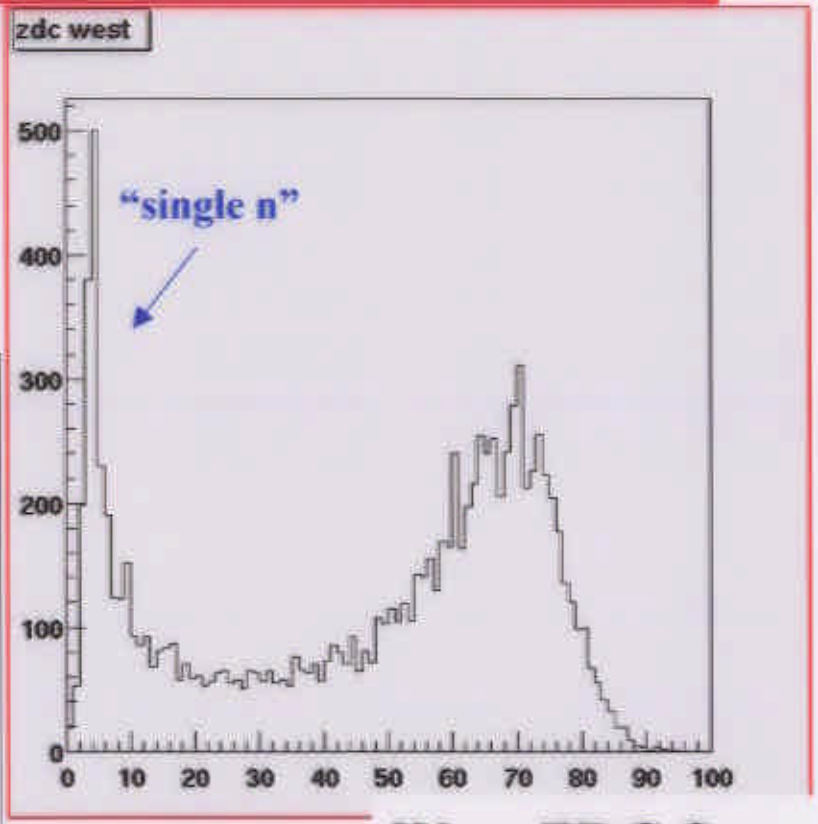
STAR

First Au+Au Collision Events at RHIC at 60 AGeV

Trigger for First Run: Zero Degree Calorimeter

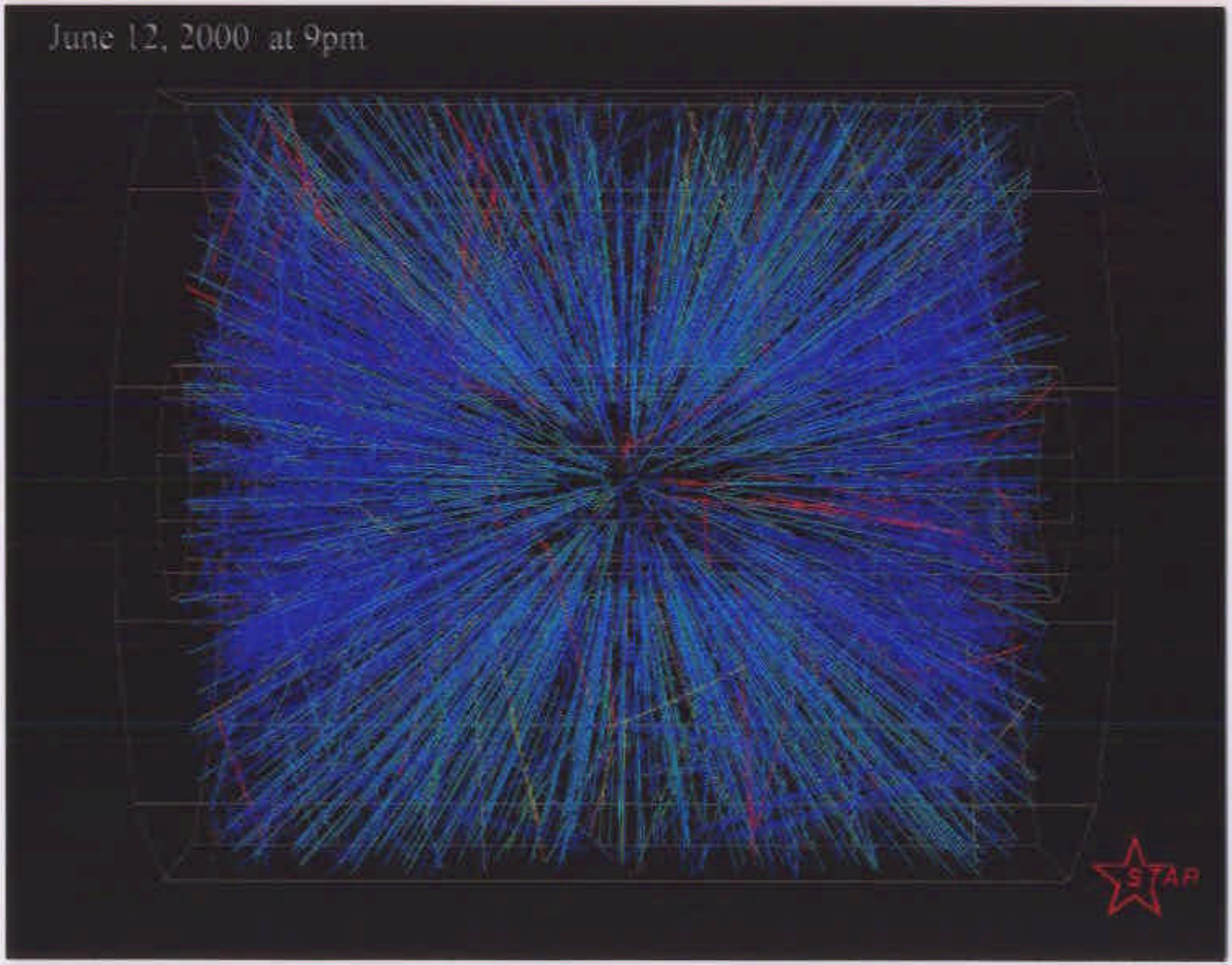
- ZDC's common to all RHIC experiments
- luminosity measure
- centrality measure
- low-level trigger





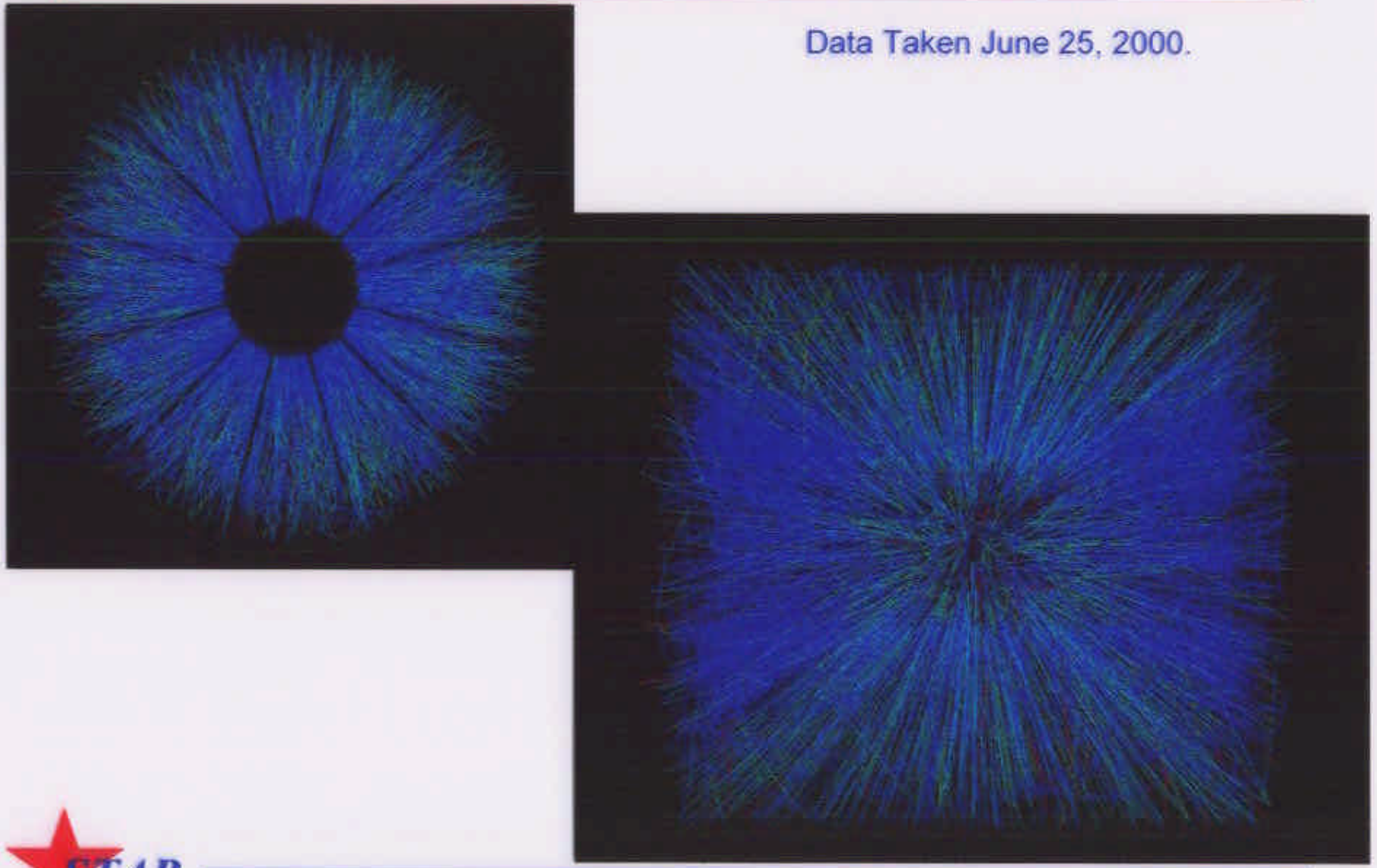
West ZDC Sum

First Au+Au Collision Events at RHIC at 60 AGeV



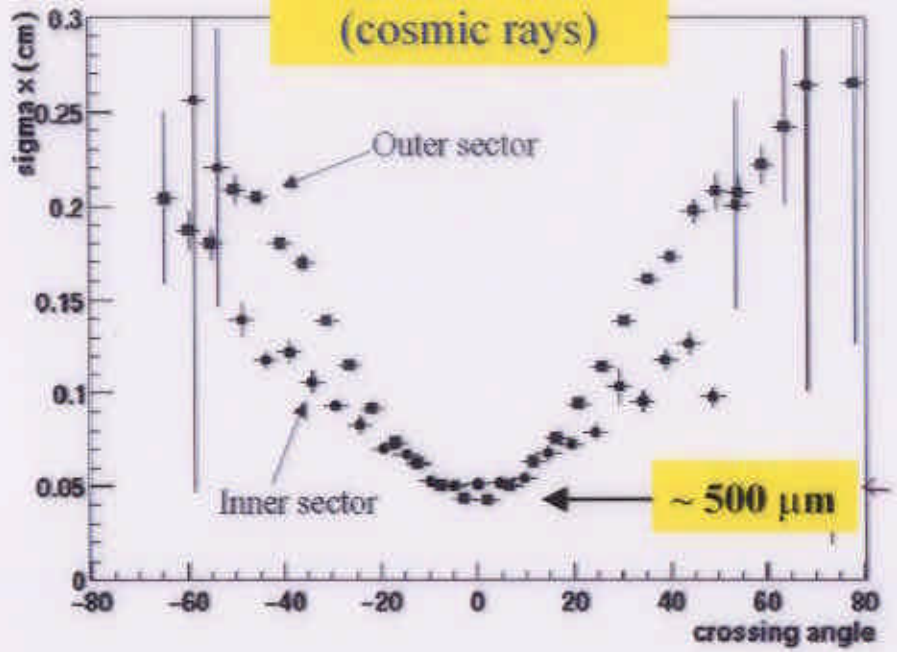
Au on Au Event at 130 AGeV

Data Taken June 25, 2000.

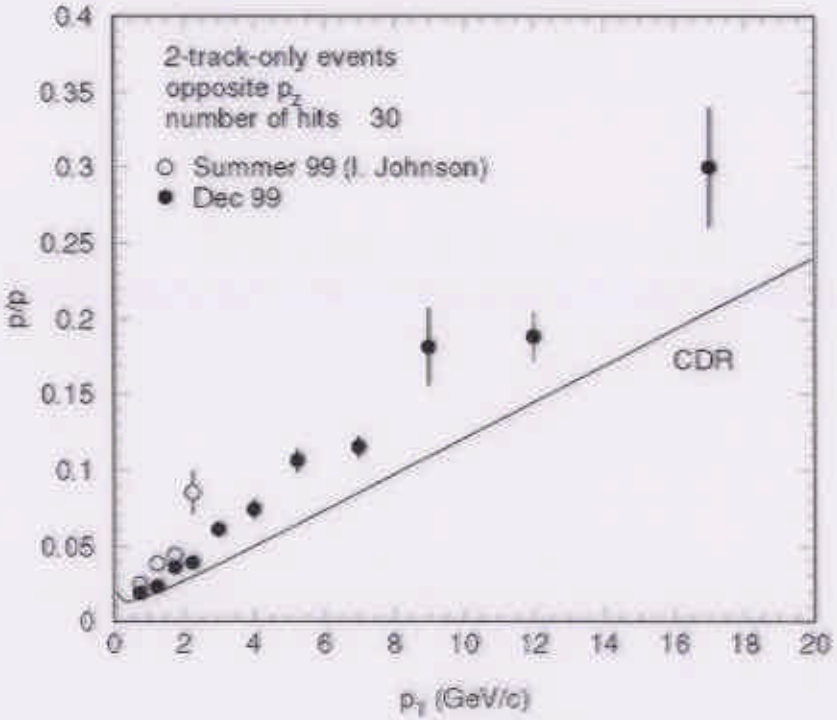


TPC Tracking

Position resolution (cosmic rays)



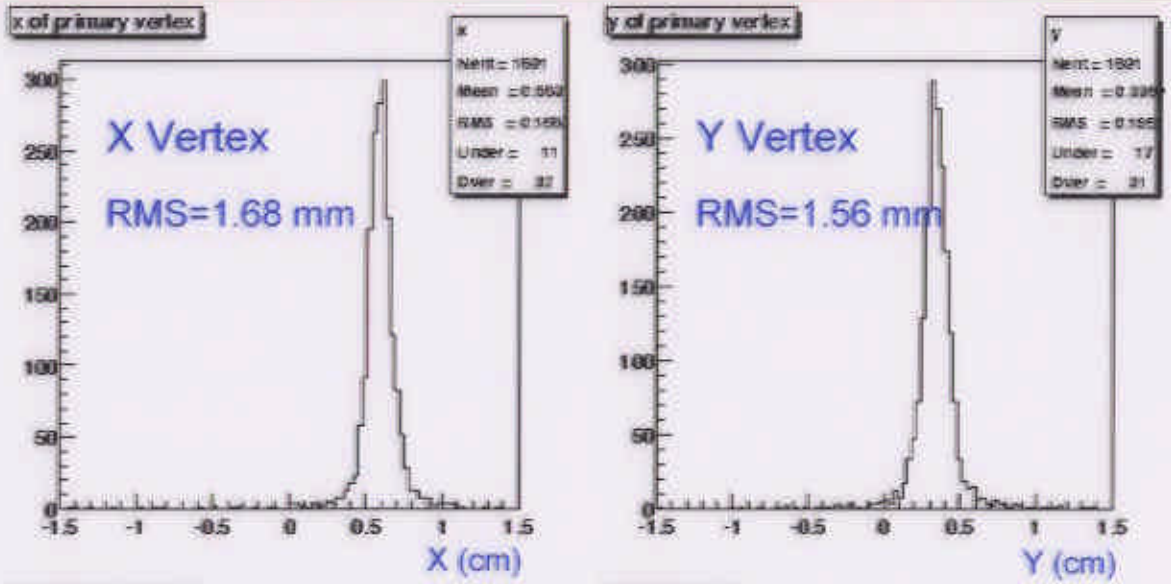
Momentum resolution (cosmics)

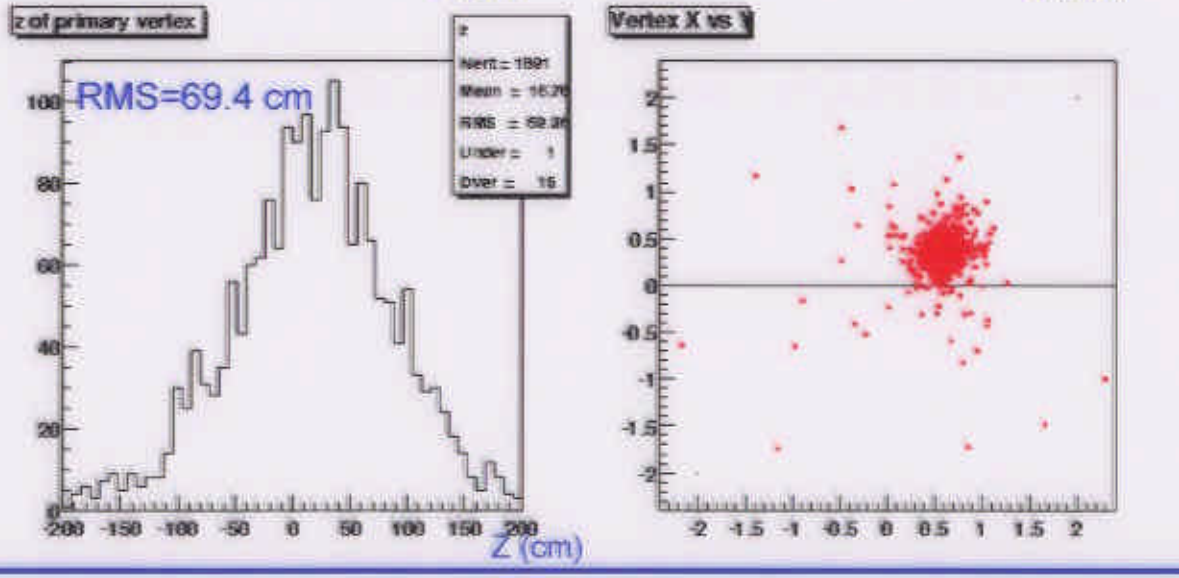


Vertex Reconstruction

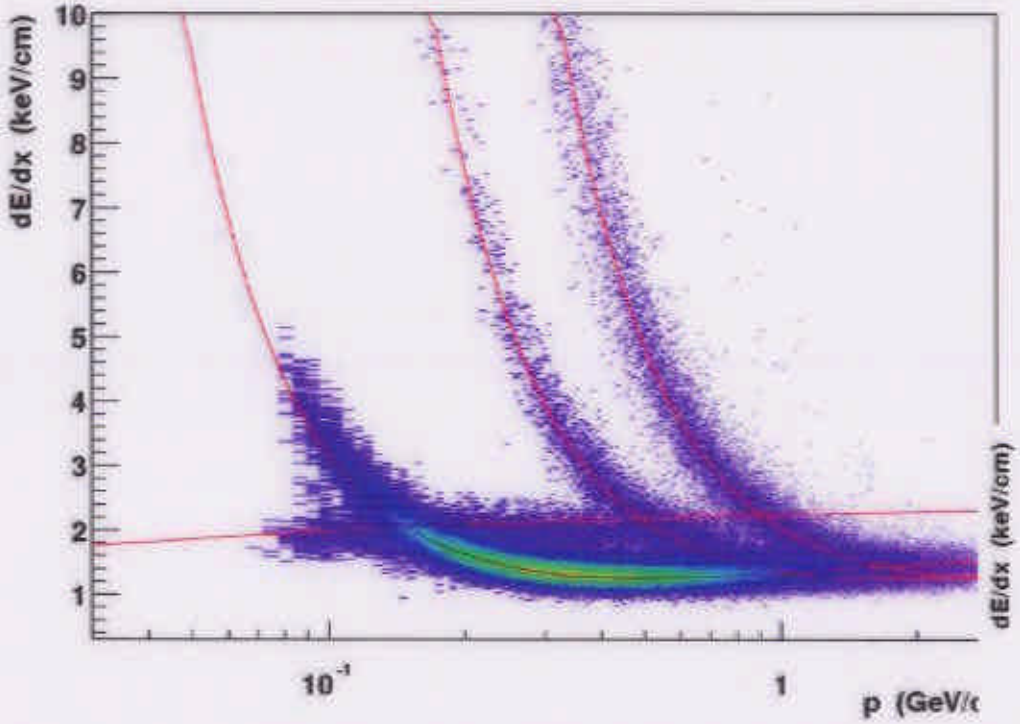
Data taken June 25, 2000.

Event vertex resolution with TPC only ≈ 100μm

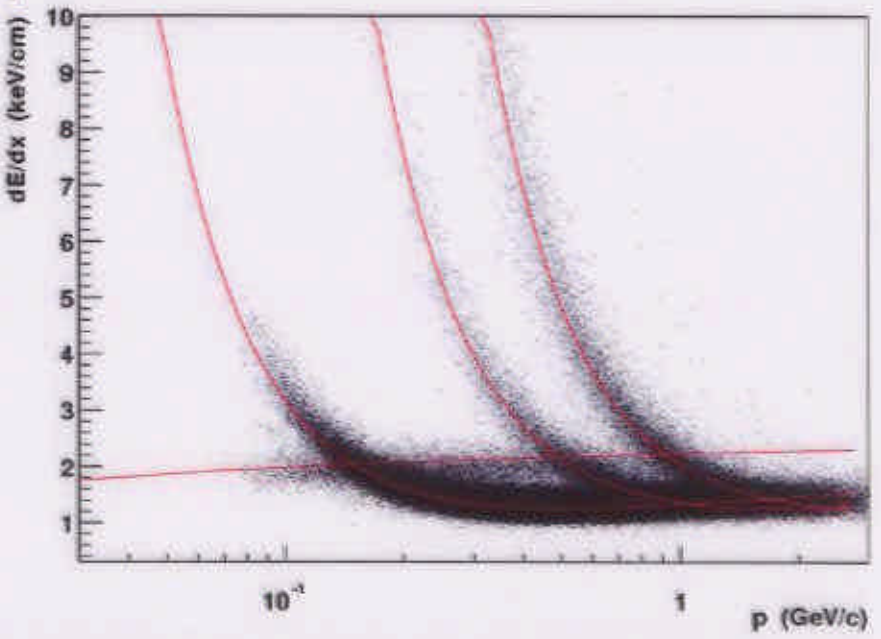




Particle Identification via dE/dx in TPC

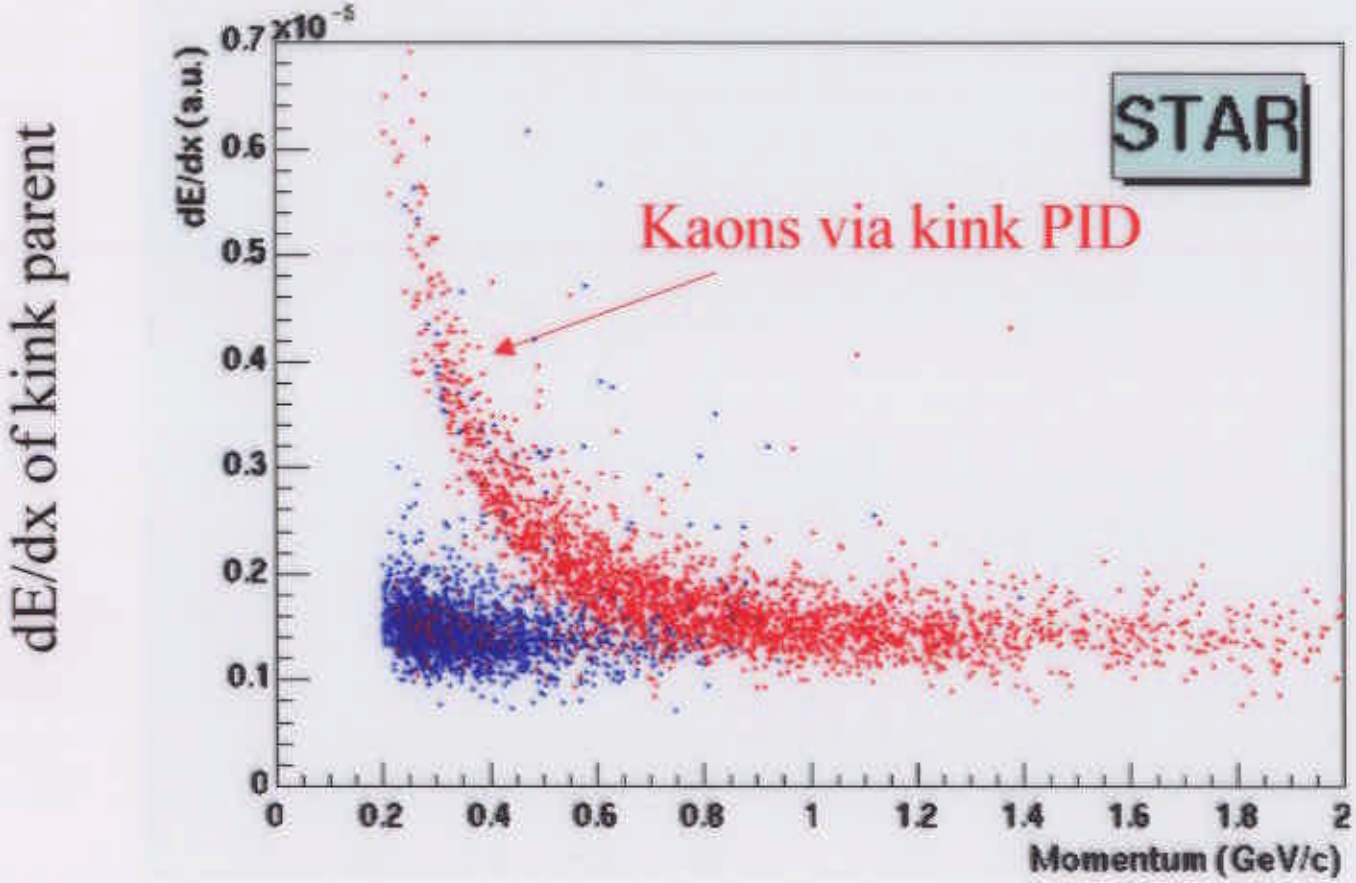


Approaching expected
5% resolution in dE/dx



Preliminary

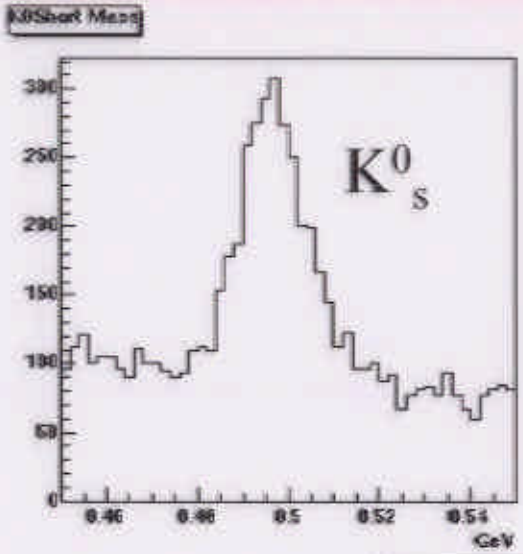
Virtuoso performance: PID via Kinks and dE/dx

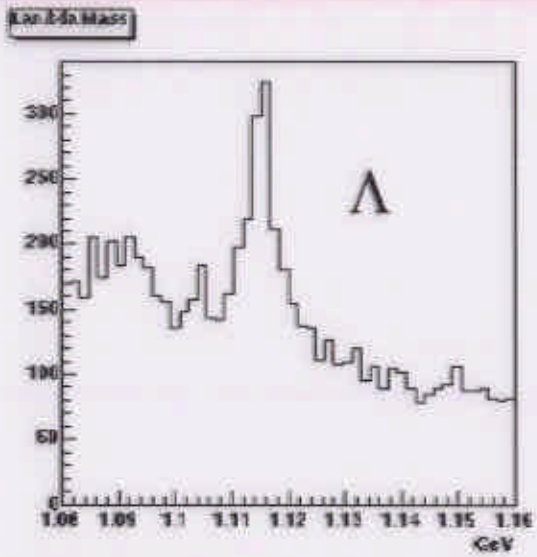


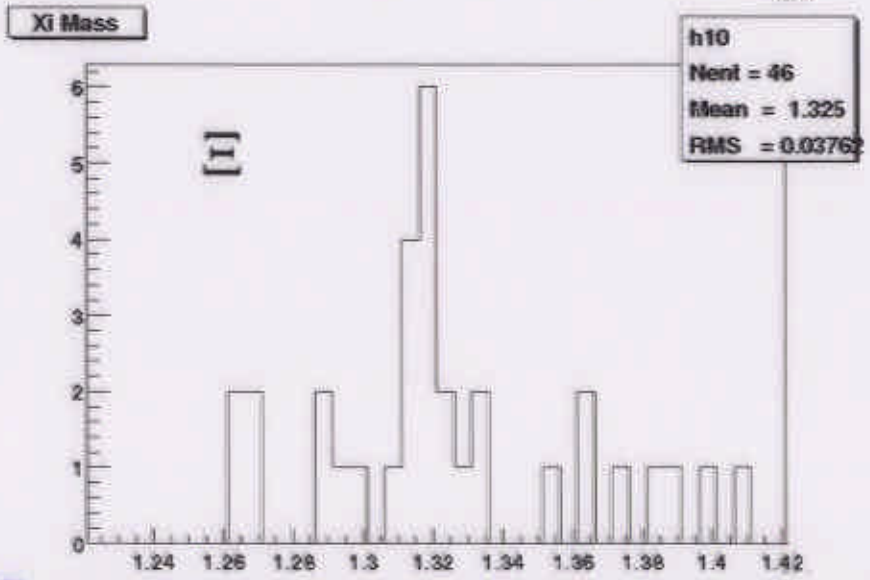
V0 reconstruction

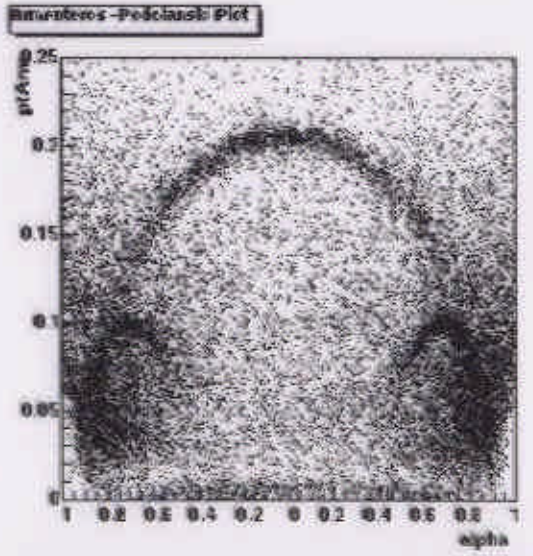
First Signals of Neutral 'Strangeness'

Preliminary









Expected Physics Measurements this year

Physics measurements we expect to accomplish with this year's data:

- dN/dη for charged particles ($\sim 1.5 \leq \eta \leq \sim 1.5$)
- dN/dy for π, K, p $(1 \leq y \leq 1)$
- $p_{\perp}$-Particle Spectra for identified particles
- K/π ratios $(1 \leq y \leq 1)$
- $p/\bar{p}$ ratios $(1 \leq y \leq 1)$
- Neutral particle decays Λ's, K_0's, .
- $\Lambda / \bar{\Lambda}$ ratios
- Particle correlations (HBT)
- Flow
- Correlated observables for event classes

Projection for Next Year's Running

Au + Au beam at top energy

(possibly at lower energy)

Si + Si and p + p at top energy

(possibly at lower energy)

Polarized p + p

Possible other beam/energy changes

depending upon what we see in this year's data

STAR is On-line!