Particle Ratios at Mid-Rapidity in Au+Au Collisions at RHIC

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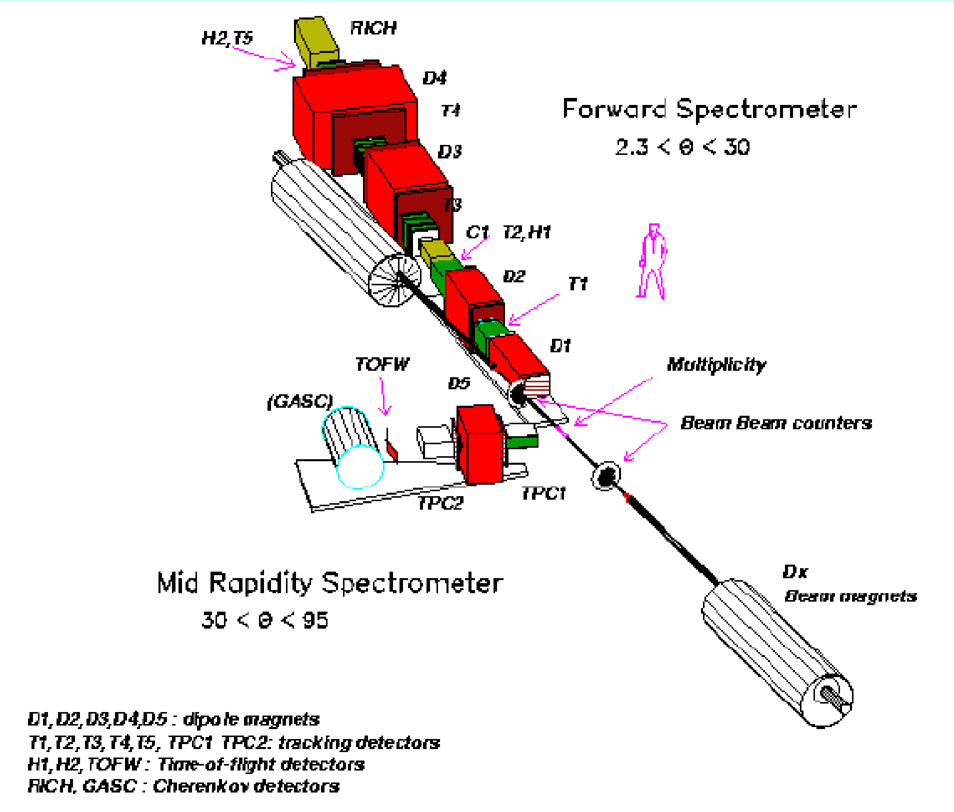
for BRAHMS Collaboration

BRAHMS

*B*road *RA*nge *H*adron *M*agnetic *S*pectrometer Experiment
at
RHIC

BRAHMS



- Measures Charged Hadrons over a Wide Angular and Large Momentum Range with High Precision
- 2 Movable Spectrometers (Mid-rapidity Spectrometer and Forward Spectrometer)
- Centrality Detectors: Tiles, Silicon Strips, Beam-Beam counters, Zero-degree Calorimeters
- Collaboration of ~55 Physicists from 11 institutions

Mid-Rapidity Spectrometer

(rotates 30^o-95^o)

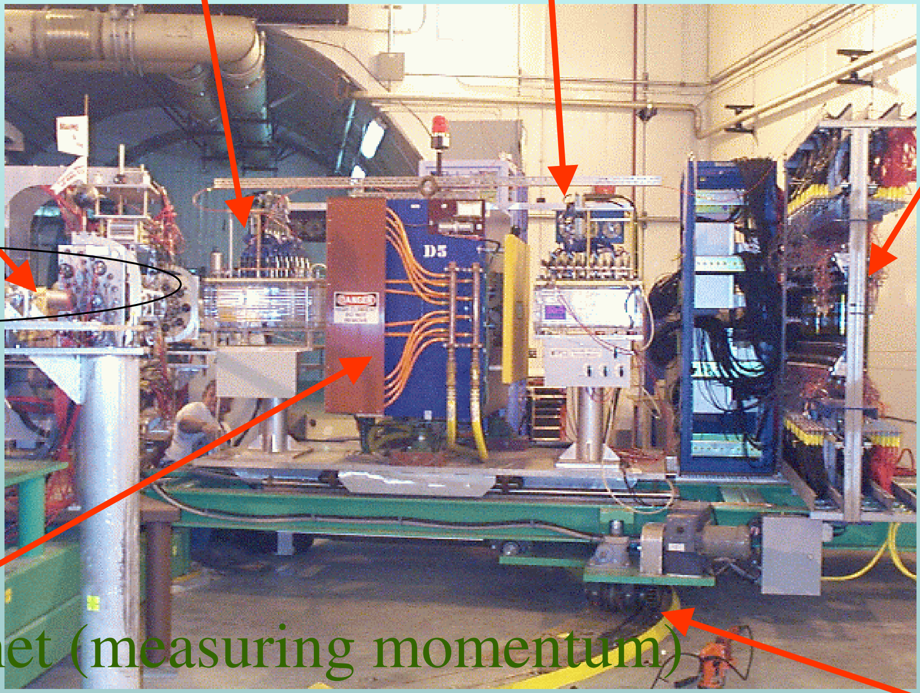
TPC1
(tracking)

TPC2
(tracking)

Time of Flight
Hodo-scope
(identifying
particles)

Beam pipe

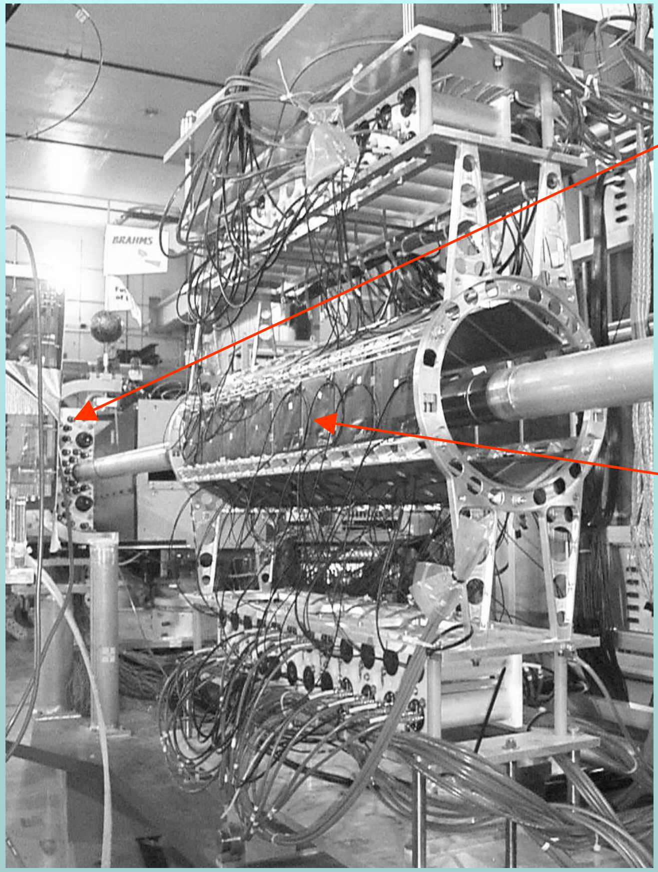
RHIC



Bending Magnet (measuring momentum)

Rail (for moving spectrometer)

Centrality Detector



- Beam-Beam Counters

  - Provide a start time and on-line trigger

  - Measure multiplicity at high η

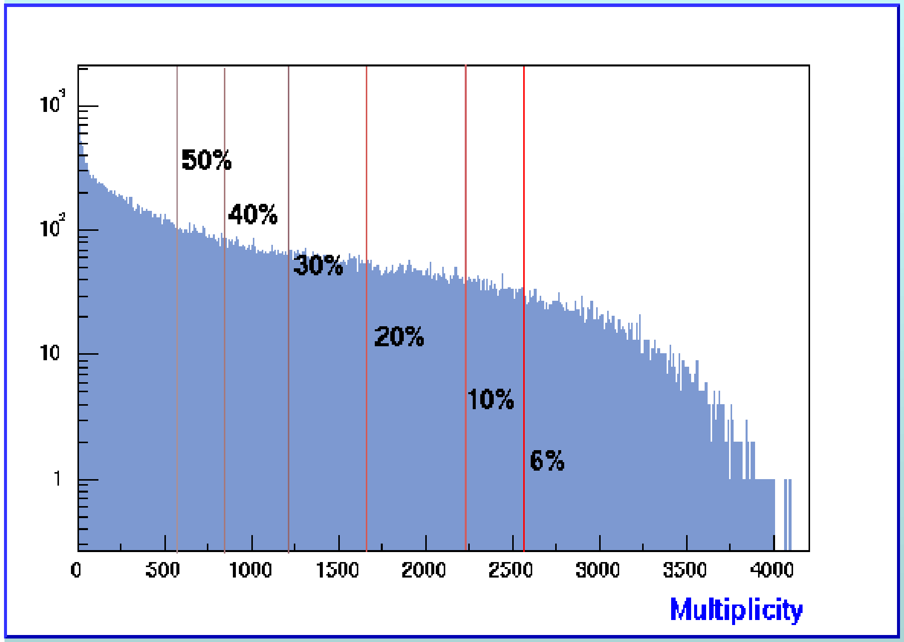
- Multiplicity Detectors (Tiles and Silicon)

  - Provide charged particle multiplicity ($-2<\eta<2$)

  - Used to characterize centralities of events

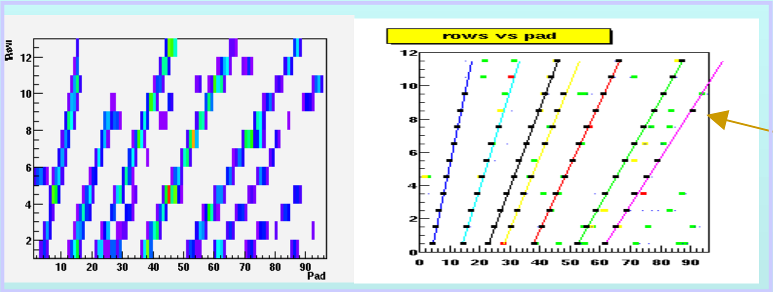
- Zero Degree Calorimeter

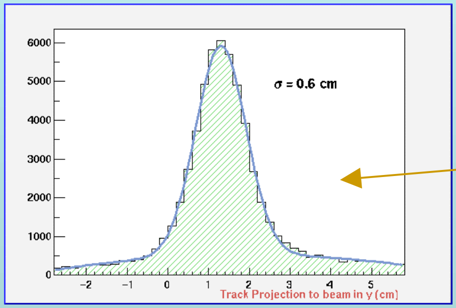
Collision Centrality Determination

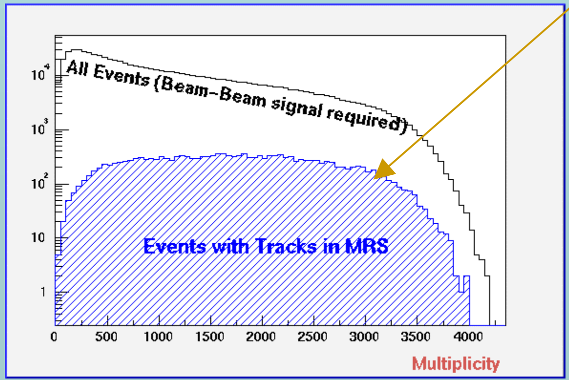


- Measured by the Centrality Detector (Scintillator Tiles)
  - Wide dynamic range
  - 38 12X12cm tiles cover $-2 < \eta < 2$ with ~70% ϕ
  - M.I.P. Equivalent Multiplicity = Energy Gain / <Minimum Ionizing Particle Energy>
- Minimum-Bias: Requiring at least 1 hit in the detector (~97% Nuclear cross section)

Track Reconstruction

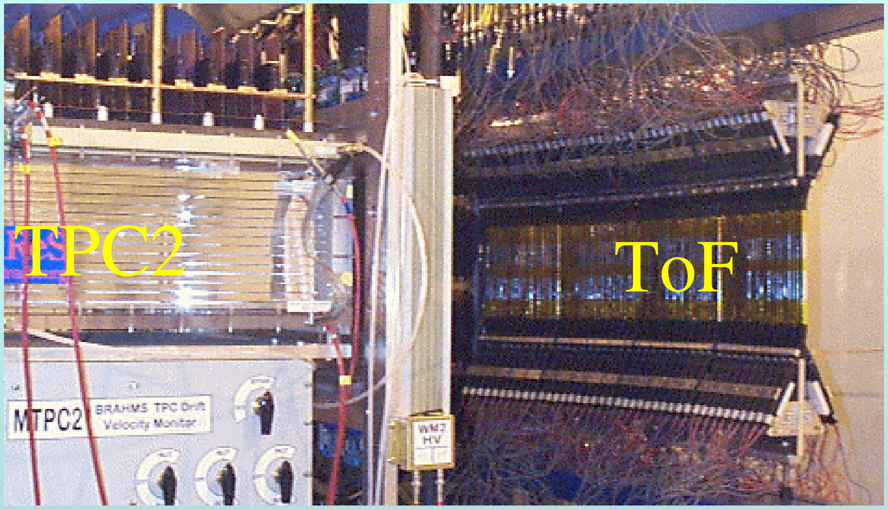


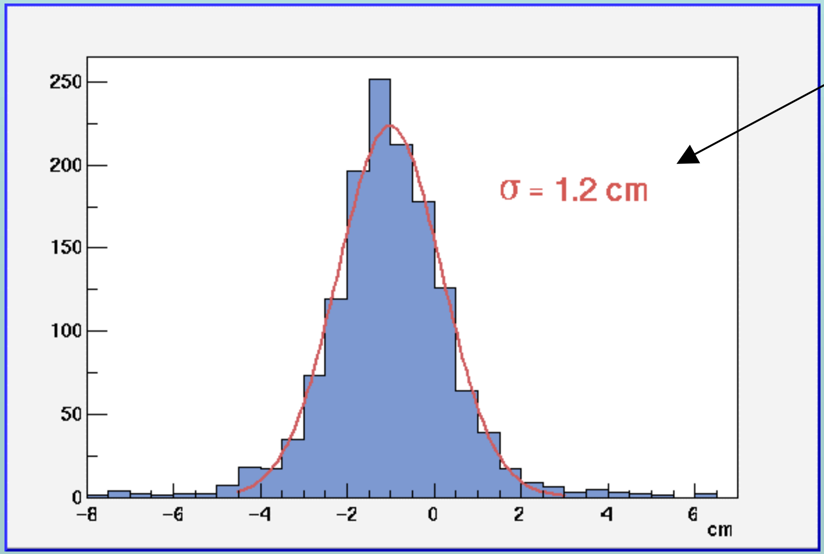




- Tracking: 2 TPC’s
- Momentum determination: from matching angle in the bending magnet
- Track selection: tracks from production vertices
- <centrality> of inclusive events = 18%
- Data set used for the analysis: MRS at 90 degree and magnet at 2KG setting

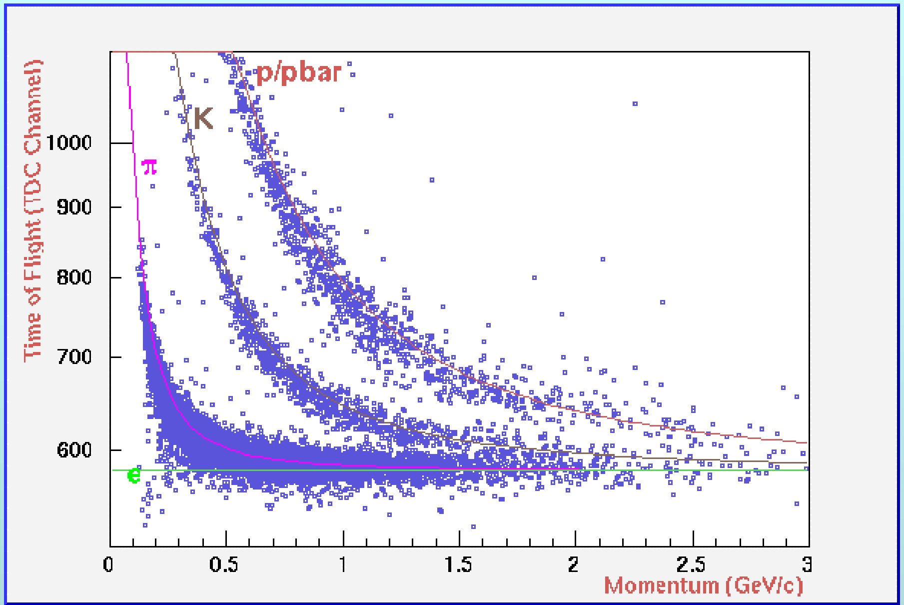
Time of Flight Hodoscope

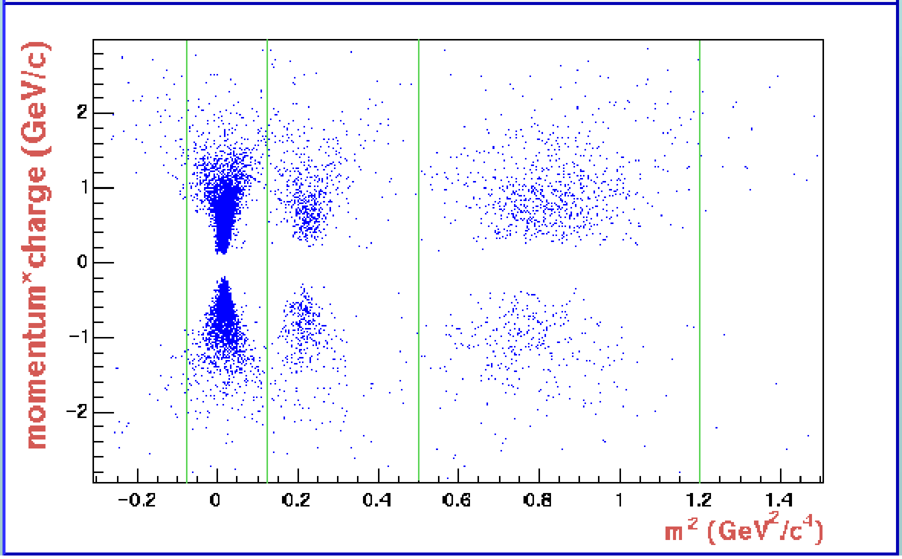




- 83 slats with "up" and "down" PMT's installed
- Slat: 1.2cm wide, 22cm high
- ~430 cm from interaction point
- Resolution: Position difference (from a projected track – from time differences) = 1.2 cm ~ 85 *p*sec without a slewing correction
- Will be fully installed (120 slats) for 2001 runs

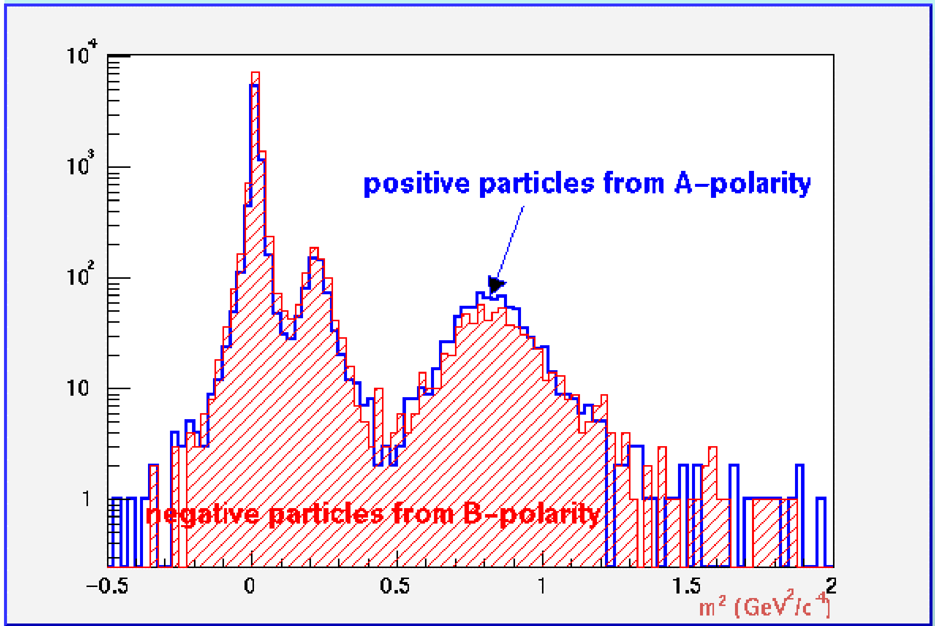
Particle Identification





- Using Time of Flight Hodoscope
- Proton and K,π separtion ~ 2GeV/*c*
- K and π separation ~1.5 GeV/*c*
- Electron “contamination” in π < 5%
- Without slewing correction

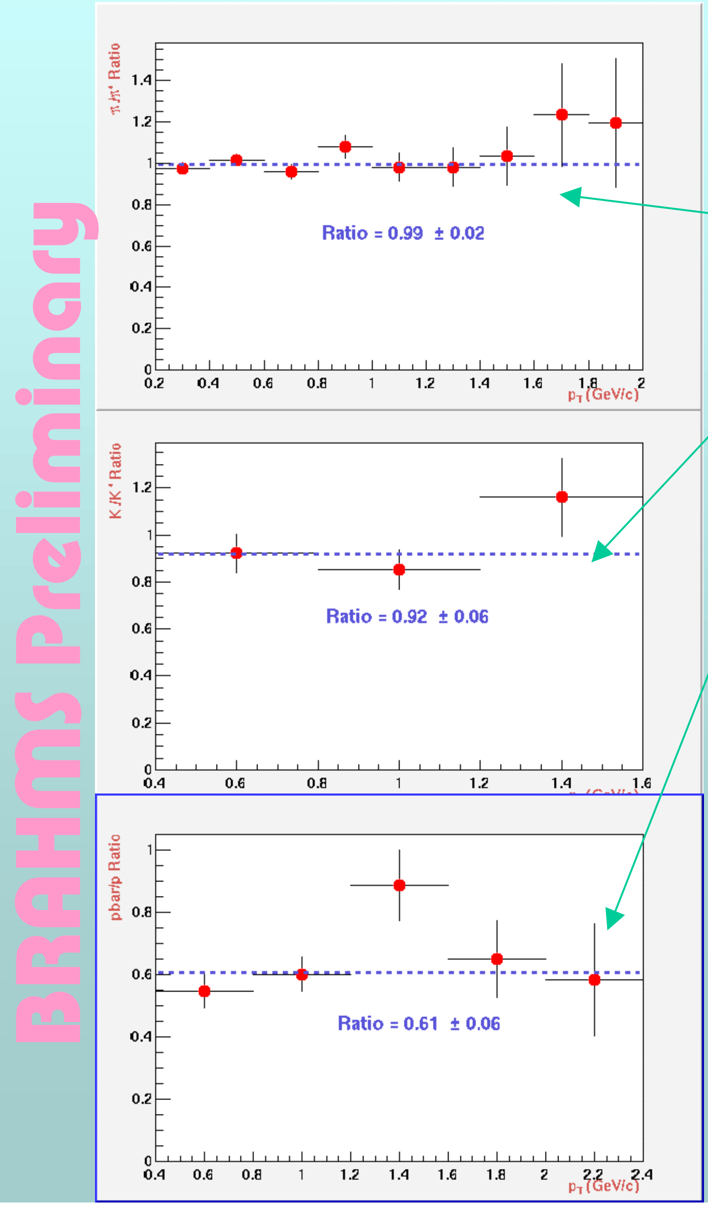
Calculating Ratios



Squared mass distributions for all momentum range from two different field settings

- (Negative particle yields from "B-polarity")/(positive particle yields from "A-polarity")
- Most of the systematic differences cancel out
- Ratios are normalized to number of events

Particle Ratios



- Ratios for "inclusive" Events (<centrality> = 18%) at Mid-rapidity
  - π^-/π^+ = 0.99 +– 0.02 +– 0.04
  - K^-/K^+ = 0.92 +– 0.06 +– 0.05
  - p-bar/p = 0.61+– 0.06 +– 0.04
- Ratios for 6% central
  - p-bar/p = 0.62+– 0.08 +– 0.05
- No significant p_T and centrality dependences observed
- p-bar/p absorption factor corrected
- No weak-decay particle (Λ…) correction applied

(Errors shown in the figures are statistical only)

Summary

- BRAHMS Mid-Rapidity spectrometer measured identified particles in p_T <2 GeV/c for p and pbar and p_T< 1.5 GeV/c for K and π
- Particle ratios

  - pbar/p ~ 0.61, K^-/K^+ ~ 0.92, π^-/π^+ ~ 1

  - No significant dependence of on p_T and centralities
- More measurements yet to come from RHIC 2001 (and beyond) running with a fully instrumented detector system and high intensity beam: BRAHMS measures identified particle yields/spectra/ratios in broad rapidity and p_T range.