# The Production of Dielectrons in Au+Au Collisions at $\sqrt{s_{NN}}$= 27 GeV from STAR

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For the STAR Collaboration

# Outline

- Motivation
  - Great probe
  - Low invariant mass region
  - Beam Energy Scan

- How
  - Electron Identification
  - Invariant Mass Reconstruction
  - Efficiency Corrections

- Summary

# Motivation

- Dileptons are excellent probes
  - Minimal final state interactions
  - Generated at all stages of the collision
- Measured @ RHIC AuAu200 + SPS energies
  - Vacuum rho meson description fails
  - Several models on the market
    - Mass may shift
    - Mass broadening



STAR QM`12



Phys. Let B, 666, 425(2008)



EPJ C, 61, 711(2009)
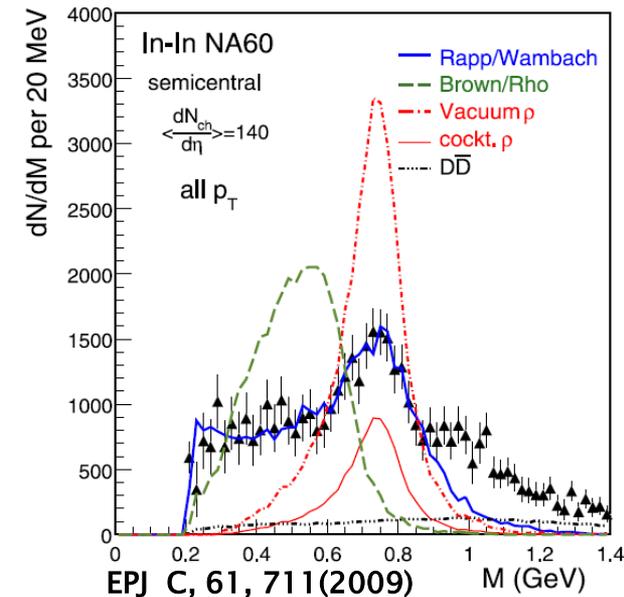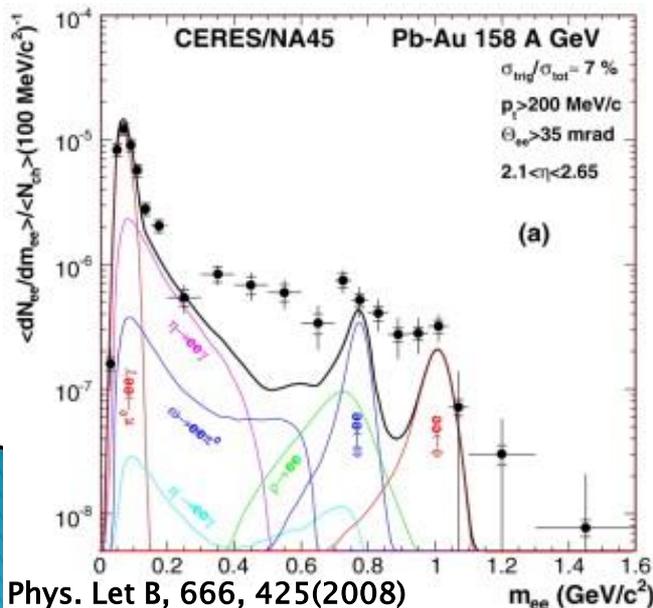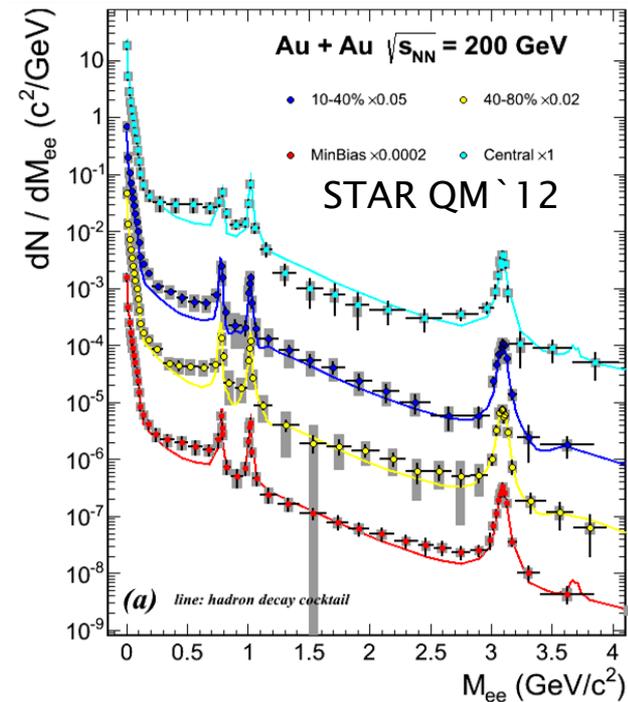
# Motivation (cont.)

- Beam Energy Scan
  - 19.6, **27**, 39, & 62 GeV w/ 15 GeV on the way
  - To probe the gap between SPS and RHIC 200
  - Changing initial conditions
    - Total baryon density remains constant
  - Study the ρ spectral function
    - As a function of energy, total baryon density
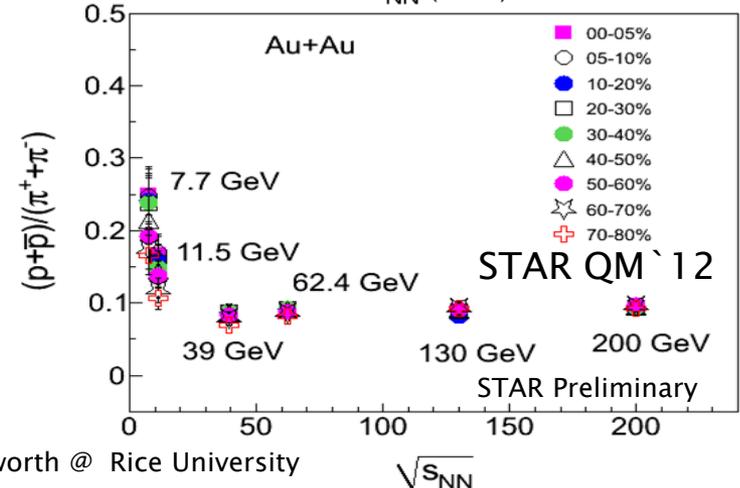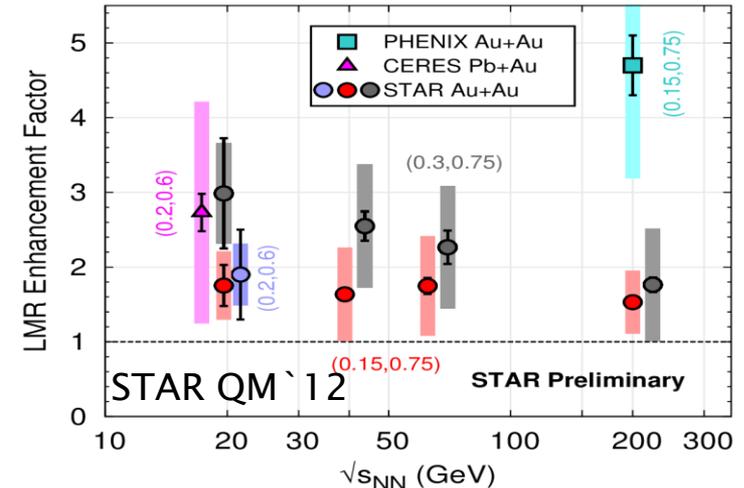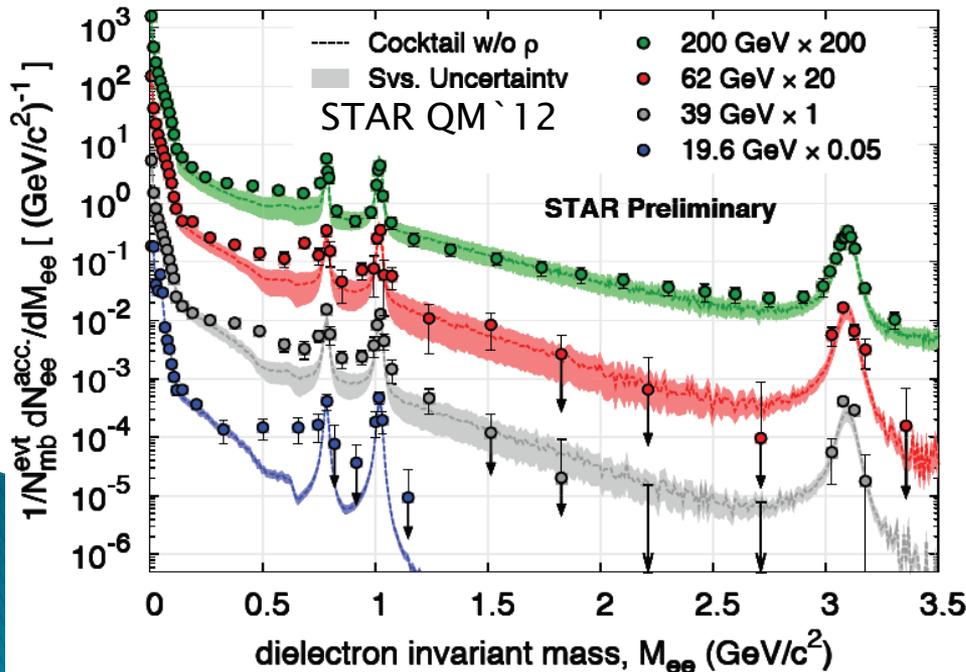
# STAR Detector

- Time Projection Chamber [TPC]
  - Tracking
  - Ionization energy loss
  - Full azimuthal coverage

- Time of Flight [TOF]
  - Precise timing ($\sigma \sim 70ps$)
  - Enables pure ePID w/ TPC
  - Full azimuthal coverage
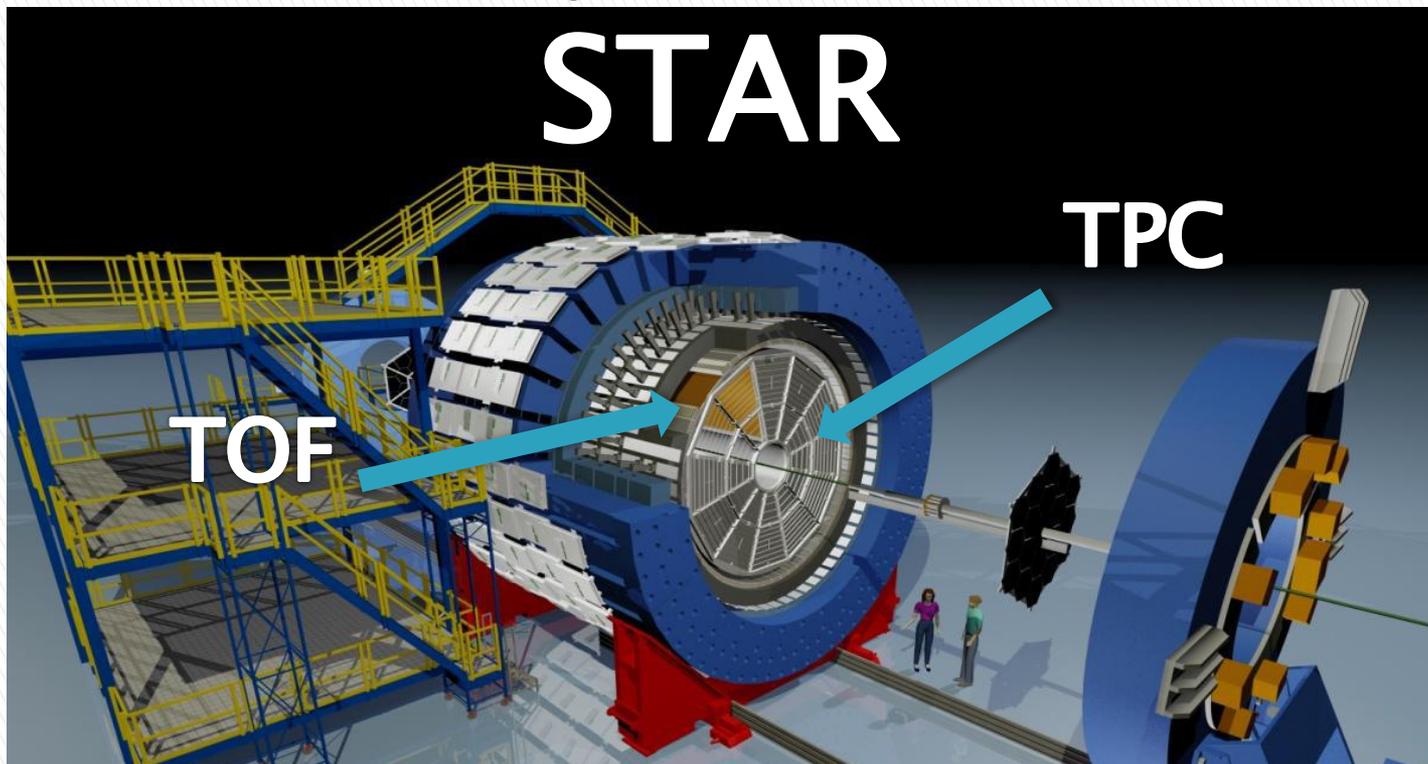
# ePID

- ## Combine the TPC+TOF
  - TPC provides:

  $$n\sigma_{el} = \left(R_{dE/dx}\right)^{-1} \ln \frac{\langle dE/dx \rangle^{\exp}}{\langle dE/dx \rangle^{th}_{el}}$$

  - Use TOF to remove slow hadrons
    - Cleans signal



TPC
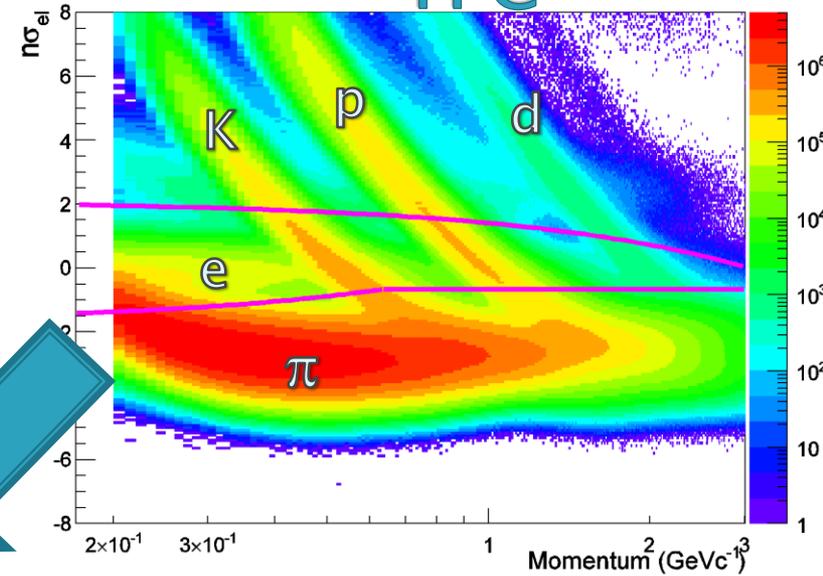
TOF
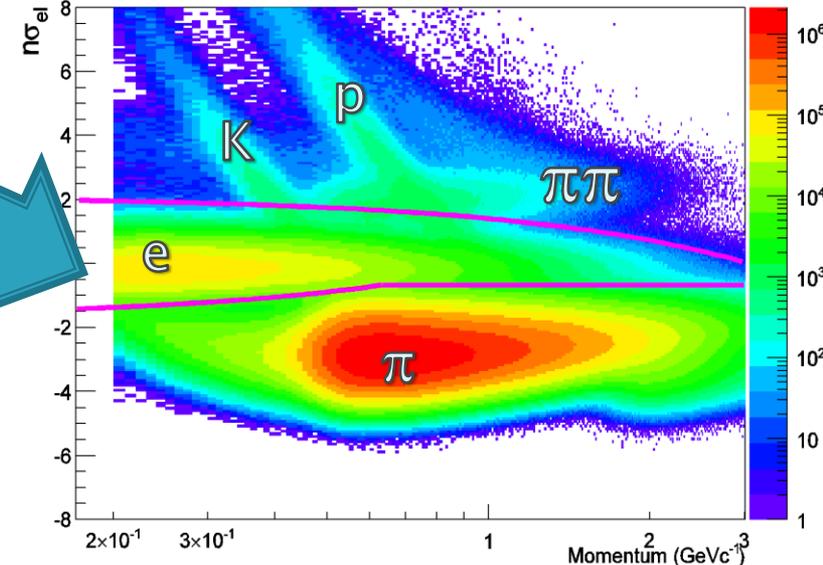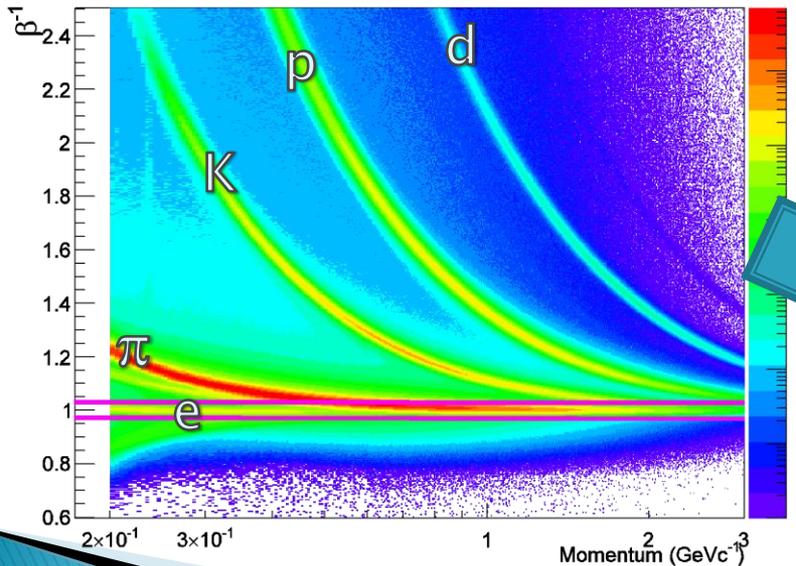
# Efficiency Corrections

▶ Correct yields

  ◦ Need a very pure sample

  ◦ Single Track Corrections

    · Tracking

      · Embedding (simulation)

    · Matching the TPC tracks with TOF

      · Photonic electrons (data)

    · ePID

      · Photonic electrons (data)

**Photonic Electron Vertex Position**
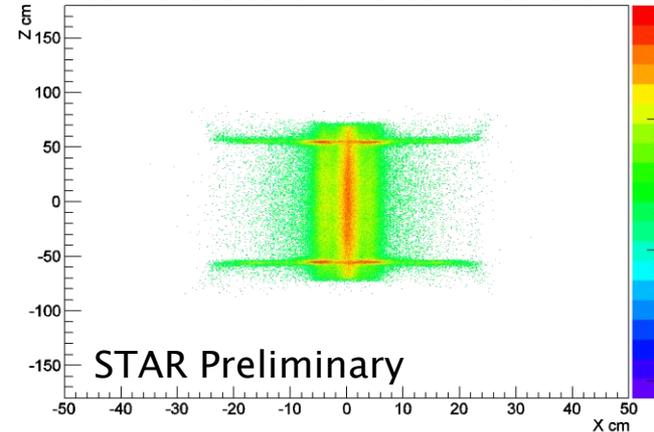
**Event Z-Vertex Position**

STAR Preliminary

STAR Preliminary
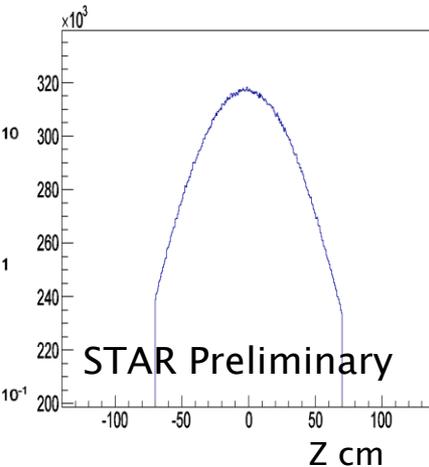
Single Track pT Efficiency for Integrated η & φ

STAR Preliminary

★ Tracking
★ Matching&Tracking
★ ePID&Tracking&Matching

pT (GeVc⁻¹)
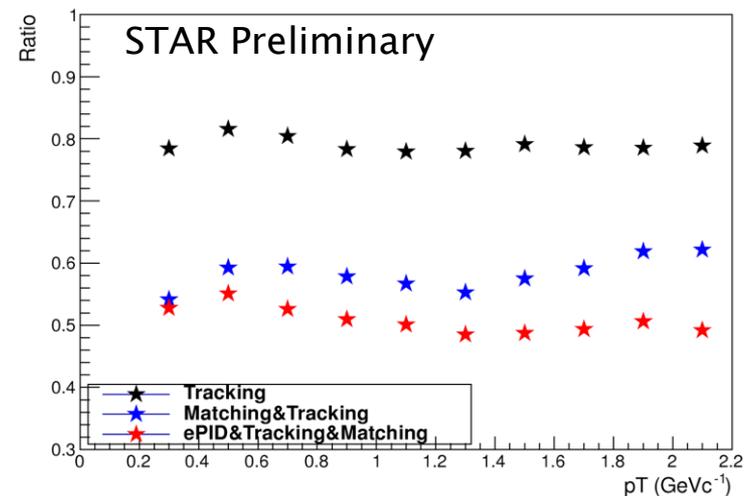
# Invariant Mass Reconstruction

- Data: 70M Min. Bias AuAu 27GeV events
  - ~8 days of data taking
- Foreground
  - Combine $e^{+/-}$ to form unlike-sign pairs, $N_{+-}$
- Background
  - Sources
    - Combinatorial
    - Correlated: jets, double Dalitz decays
    - Photon conversions
  - Removal Techniques
    - Like sign mixing from the same event
      - Removes combinatorial & correlated backgrounds
      - Correct for acceptance difference by mixing events
      - $2\sqrt{N_{++}N_{--}}\dfrac{ME_{+-}}{2\sqrt{ME_{++}ME_{--}}}$
    - Pair cuts to remove conversions
- Signal
  - Subtract background from foreground
  - Signal to background is challenging



Raw Invariant Mass

$N_{+-}$

$N_{+-} - \dfrac{2\sqrt{N_{++}N_{--}}\,ME_{+-}}{2\sqrt{ME_{--}ME_{++}}}$

STAR Preliminary

$M_{ee}$ (GeV/c$^2$)



Signal to Background Ratio

STAR Preliminary

$M_{ee}$ (GeV/c$^2$)

Butt
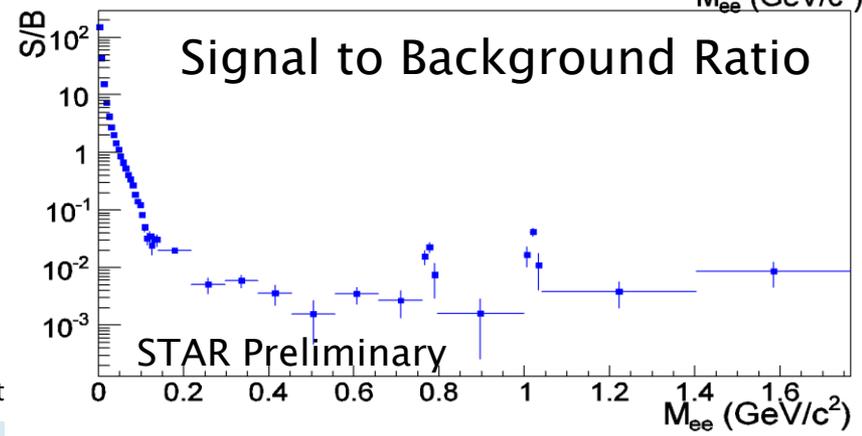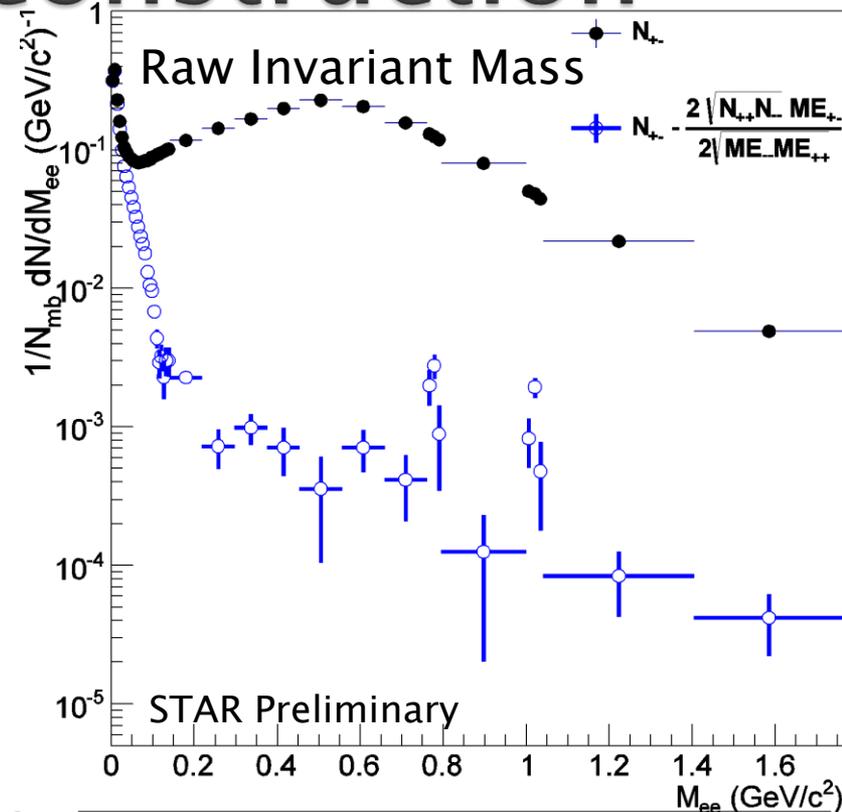
# Summary

- Beam Energy Scan provides an excellent opportunity to study the rho meson modification extensively

- We present the raw dielectron mass spectra at this energy, 27GeV

- Outlook:
  - Generate pair efficiency
  - Generate the contribution from known hadronic sources
  - Determine Systematic Errors
  - Compare with model predictions
  - Include AuAu 15GeV data (2014)

# Thank you