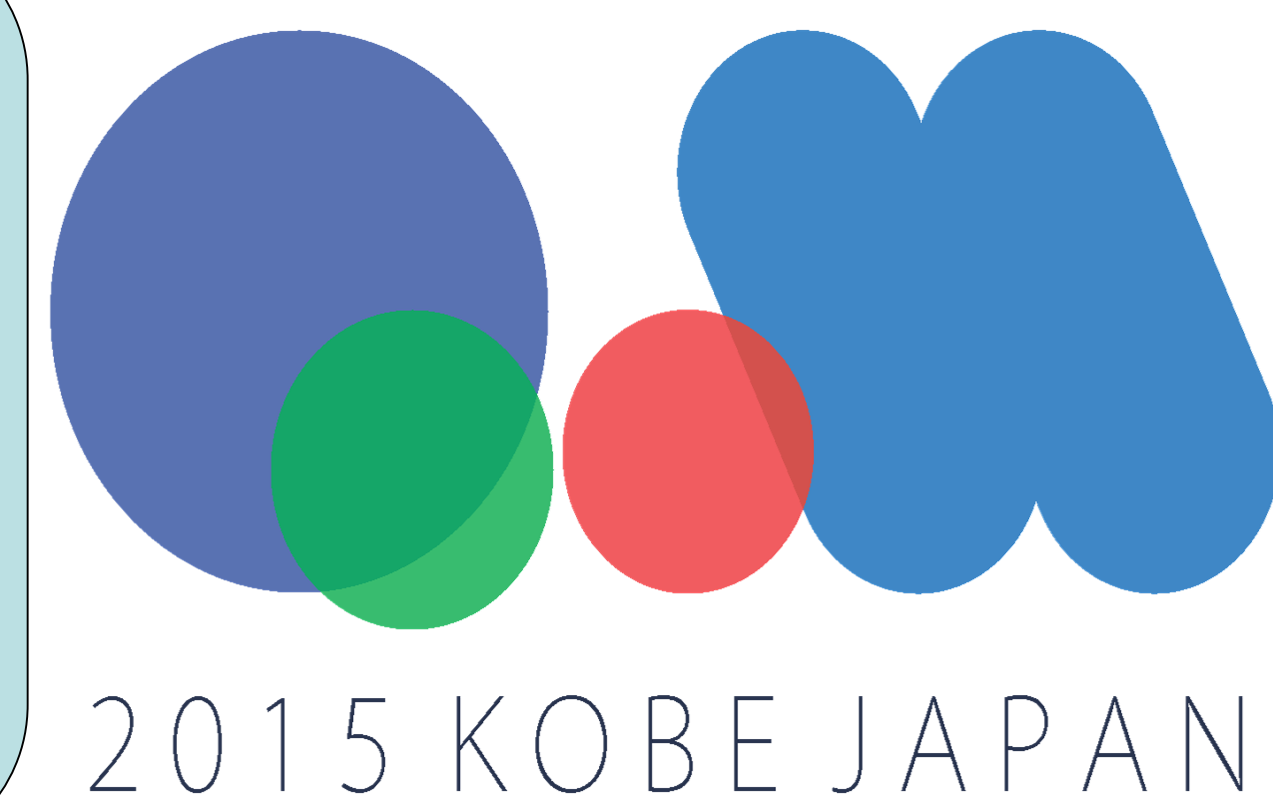


Measurements of heavy flavor decay electron production in p+p collisions at $\sqrt{s}=200$ GeV at STAR

Shenghui Zhang, for the STAR Collaboration

University of Science and Technology of China (USTC)

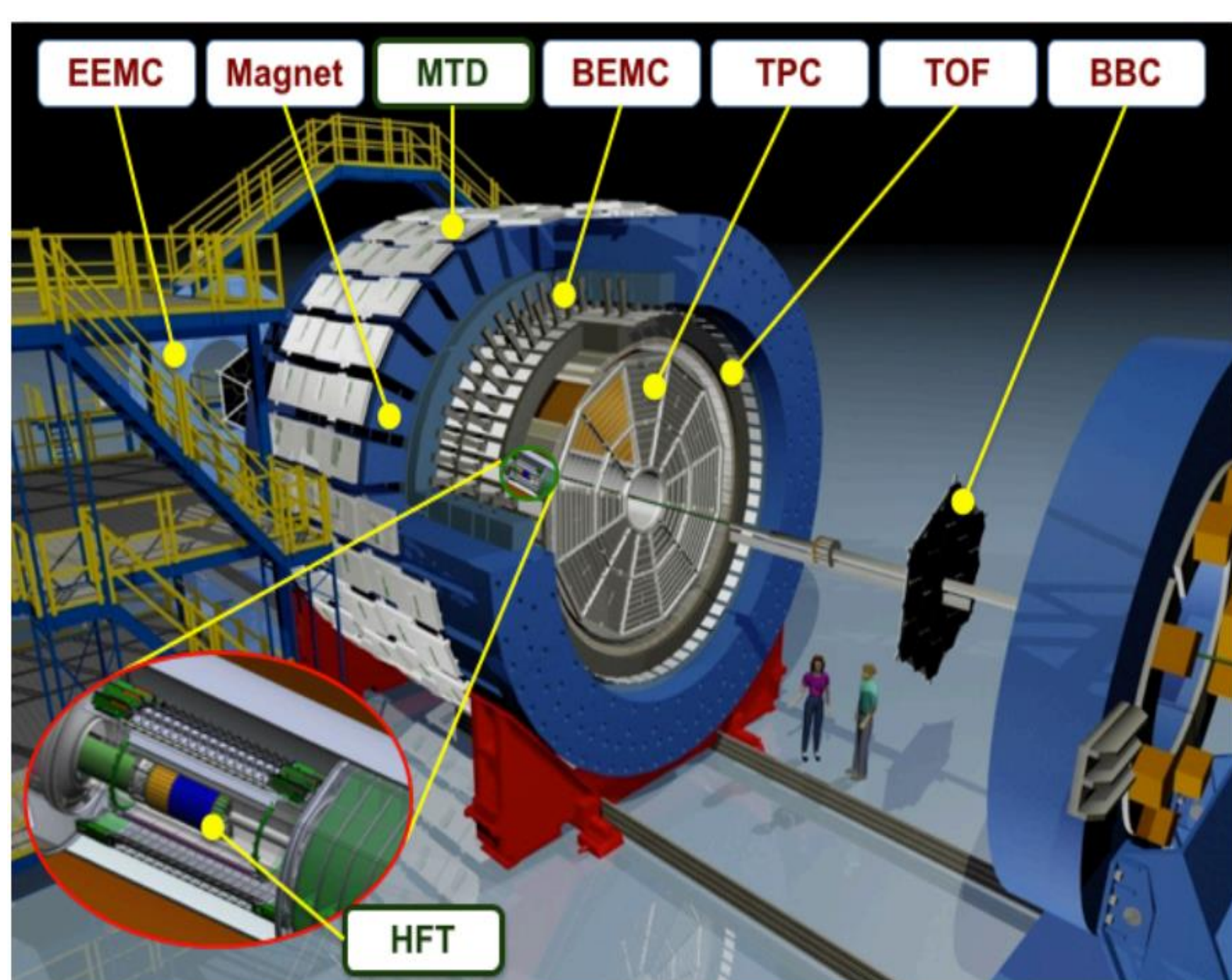


Abstract

Heavy quarks are believed to be produced at early stages of high-energy heavy-ion collisions. Measurements of heavy quarks can improve our understanding of parton interactions with the Quark-Gluon Plasma (QGP) and its properties. Heavy quark production in p+p collisions is a baseline to investigation of the QGP in heavy-ion collisions and is expected to be well described by perturbative Quantum Chromodynamics (pQCD). However, the pQCD calculations have large uncertainties at low transverse momentum (p_T). Thus measurements of heavy quark production at low p_T in p+p collisions, which can be studied by measuring electrons from semi-leptonic decays of heavy flavor hadrons, are crucial for constraining the pQCD models.

In this poster, we will present the STAR measurements of low p_T heavy flavor decay electron (HFE) production in p+p collisions at $\sqrt{s}=200$ GeV in RHIC run 2012.

STAR Detector



Time Projection Chamber

- $|\eta| < 1$, full azimuth
- Tracking, momentum.
- PID through dE/dx

Time of Flight

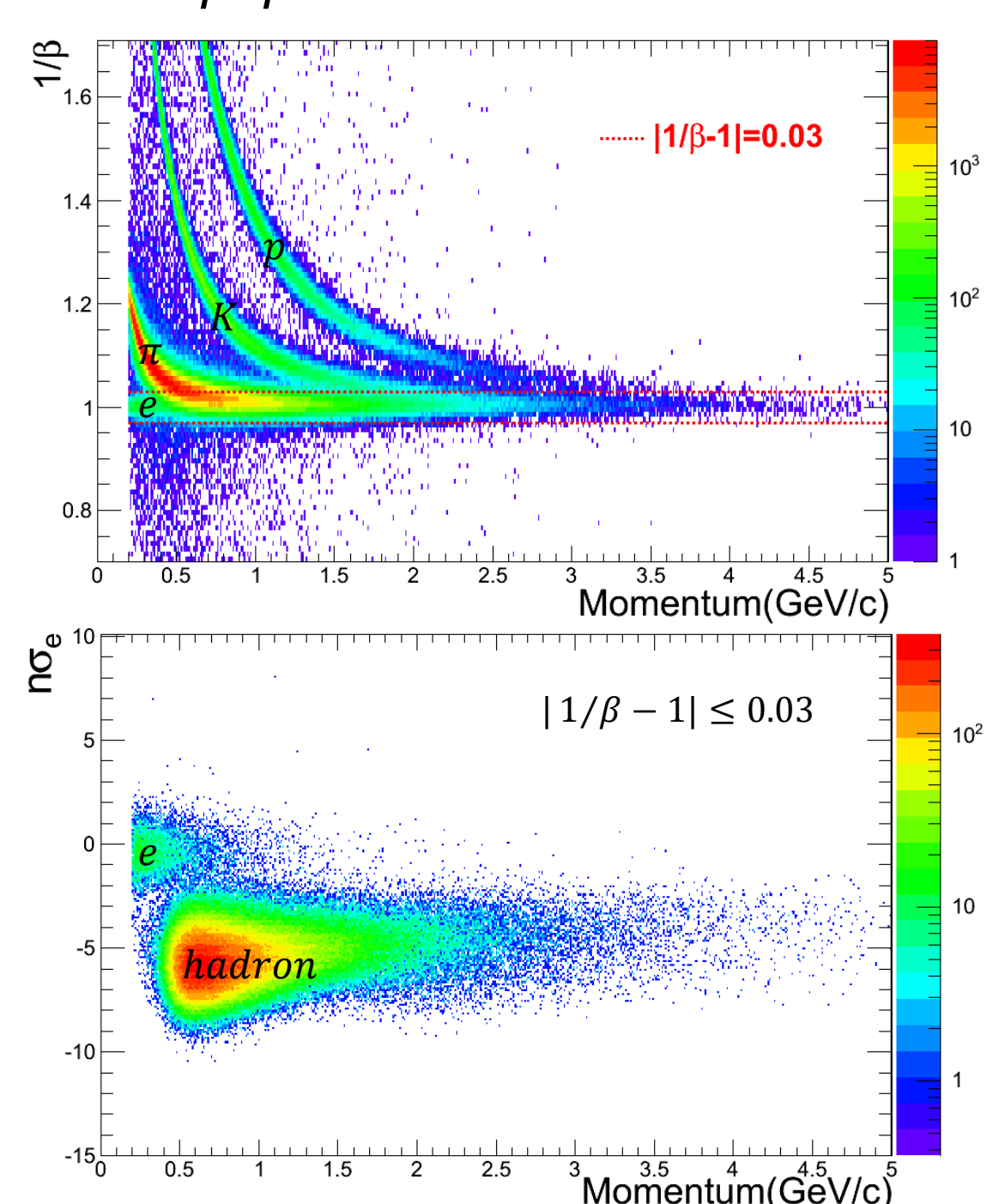
- $|\eta| < 0.9$, full azimuth
- PID through TOF
- Timing resolution: ~ 85 ps.

Barrel Electromagnetic Calorimeter

- $|\eta| < 1$, full azimuth
- p/E for PID
- Fast online trigger

Electron Identification

Dataset: 299M min-bias events from p+p 200 GeV from Run 12



Analysis

Inclusive electron

- 1) Part of hadrons rejected by dE/dx and velocity cuts
- 2) Fit $n\sigma_e$ distribution ($n\sigma_e = \ln\left(\frac{dE/dx}{dE/dx_e}\right) / R_{dE/dx}$)
 - hadron fit function: $C * \exp\left\{-0.5 * \left(\frac{x-\mu}{\sigma}\right)^2 - \exp\left(-\frac{x-\mu}{\sigma} * \eta\right)\right\}$
 - electron fit function: Gaussian
- 3) Get purity according to $n\sigma_e$ distribution and cut

Photonic electron

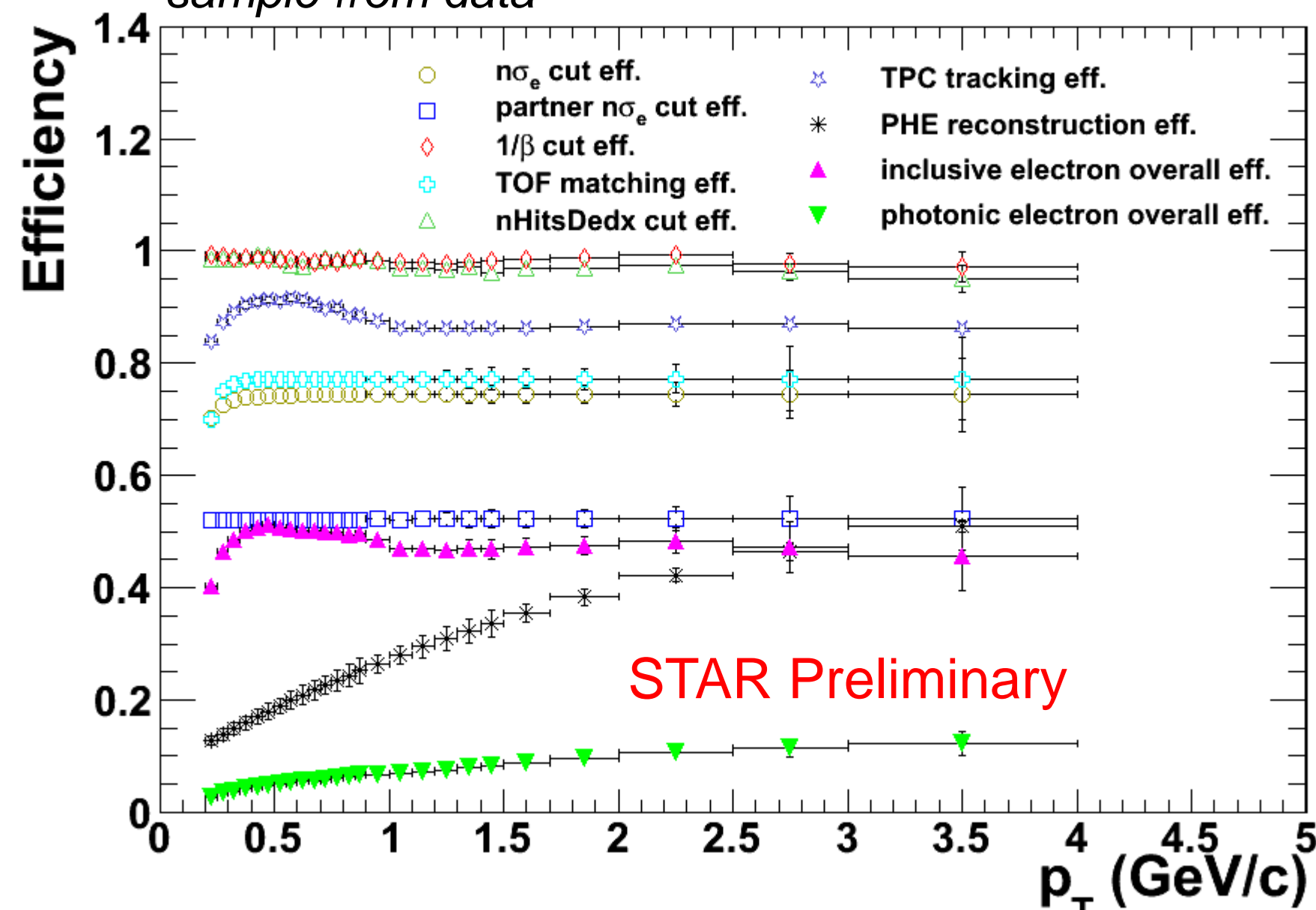
- 1) Tagged electron + partner electron, get M_{ee} distribution ($M_{ee} < 0.15$ GeV/c², pairDca < 3.0cm)
- 2) Background reconstruction: UnlikeSign – LikeSign (same event)

Non-Photonic electron (NPE)

$$N(\text{inclusive}_e) * \text{purity} - \frac{N(\text{photonic}_e)}{\text{Photonic } e \text{ reconstruction eff.}}$$

Efficiency

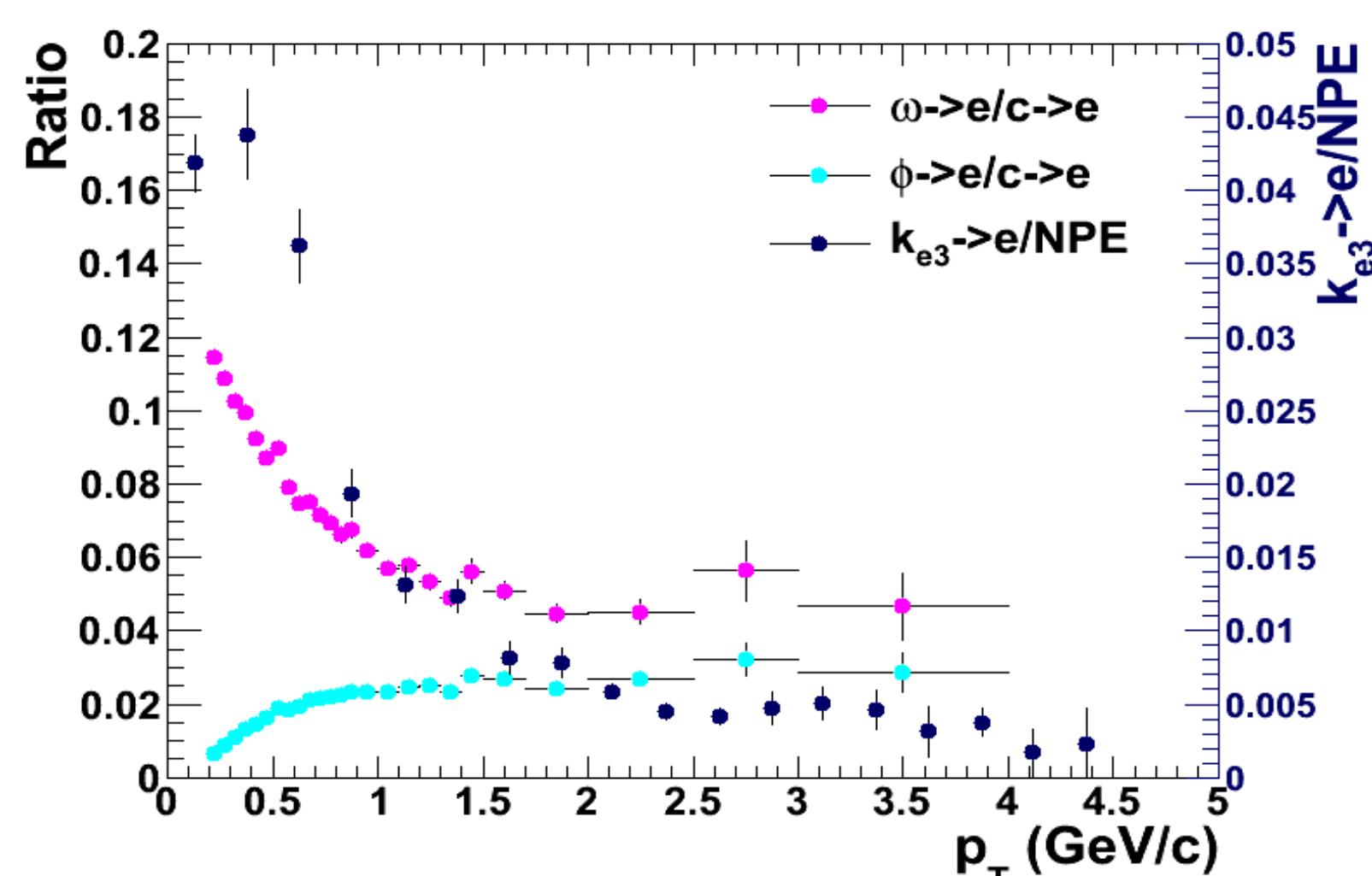
- TPC tracking eff. and PHE reconstruction eff. are from MC simulations (embedding)
- Other effs. are extracted using photonic electron sample from data



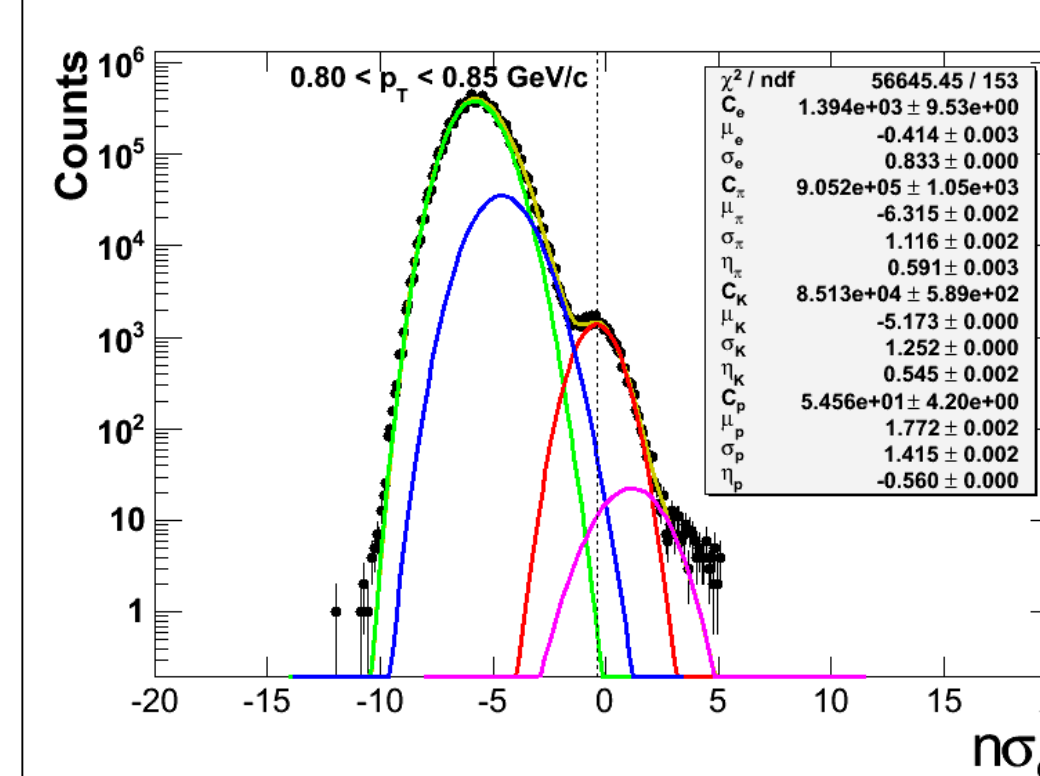
Background from hadron decays

Study background by simulations

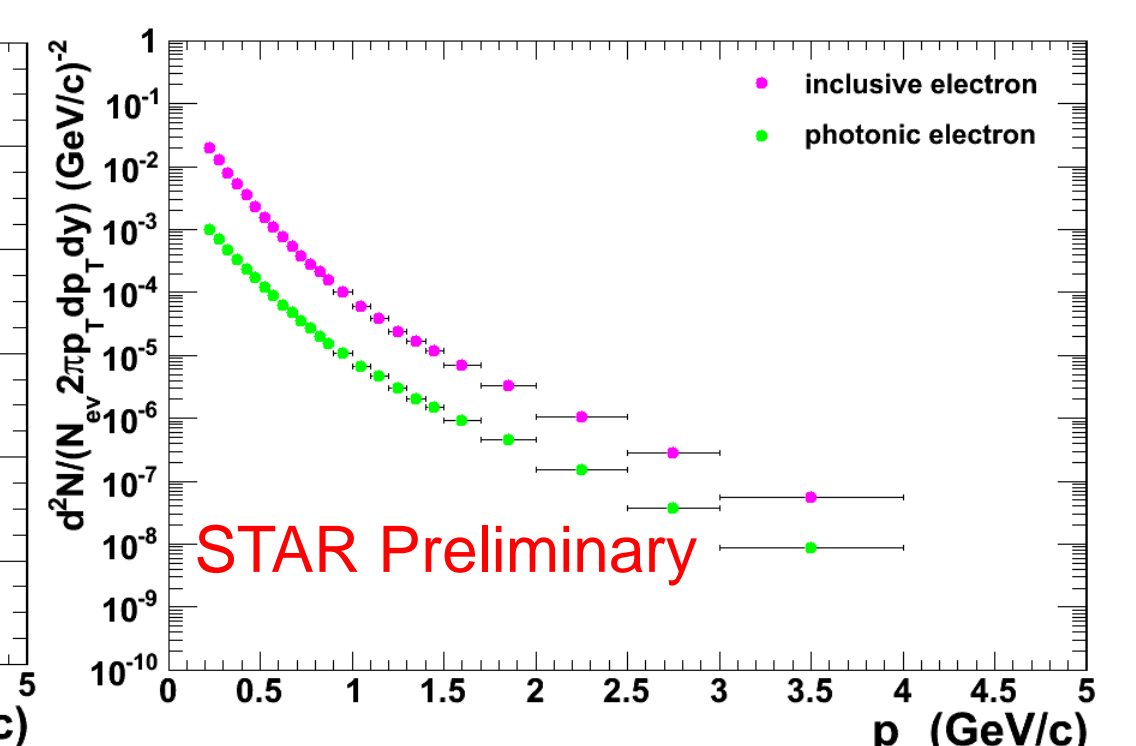
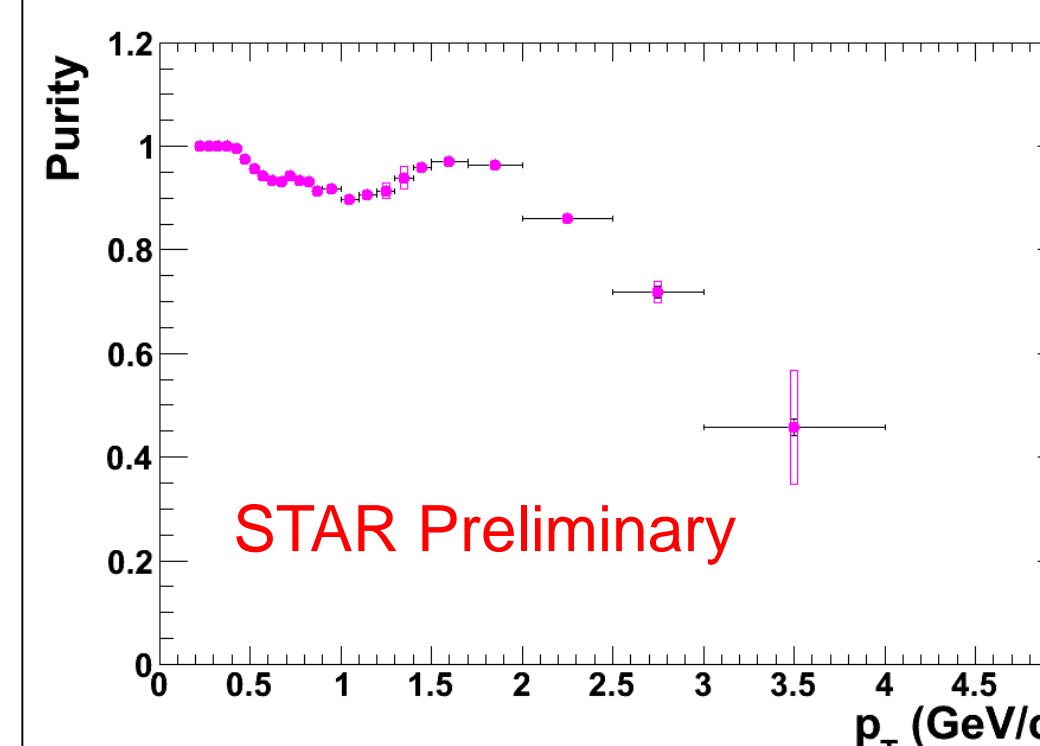
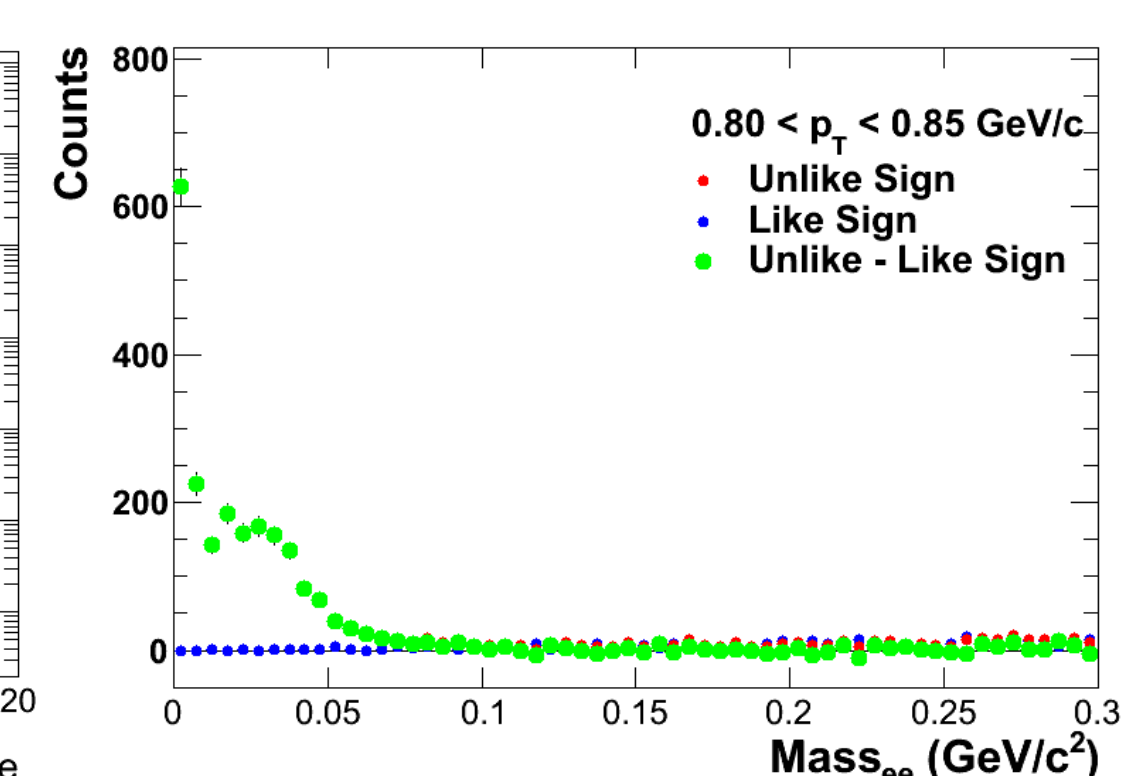
- 1) $K \rightarrow e\pi\nu(K_{e3})$: $K^+ \rightarrow e^+\pi^0\nu$, $K_L^0 \rightarrow e^\pm\pi^\mp\nu$
- 2) dielectron decays of vector mesons: $\omega \rightarrow e^+e^-/\omega \rightarrow \pi^0e^+e^-$, $\phi \rightarrow e^+e^-/\phi \rightarrow \eta e^+e^-$



Inclusive electron

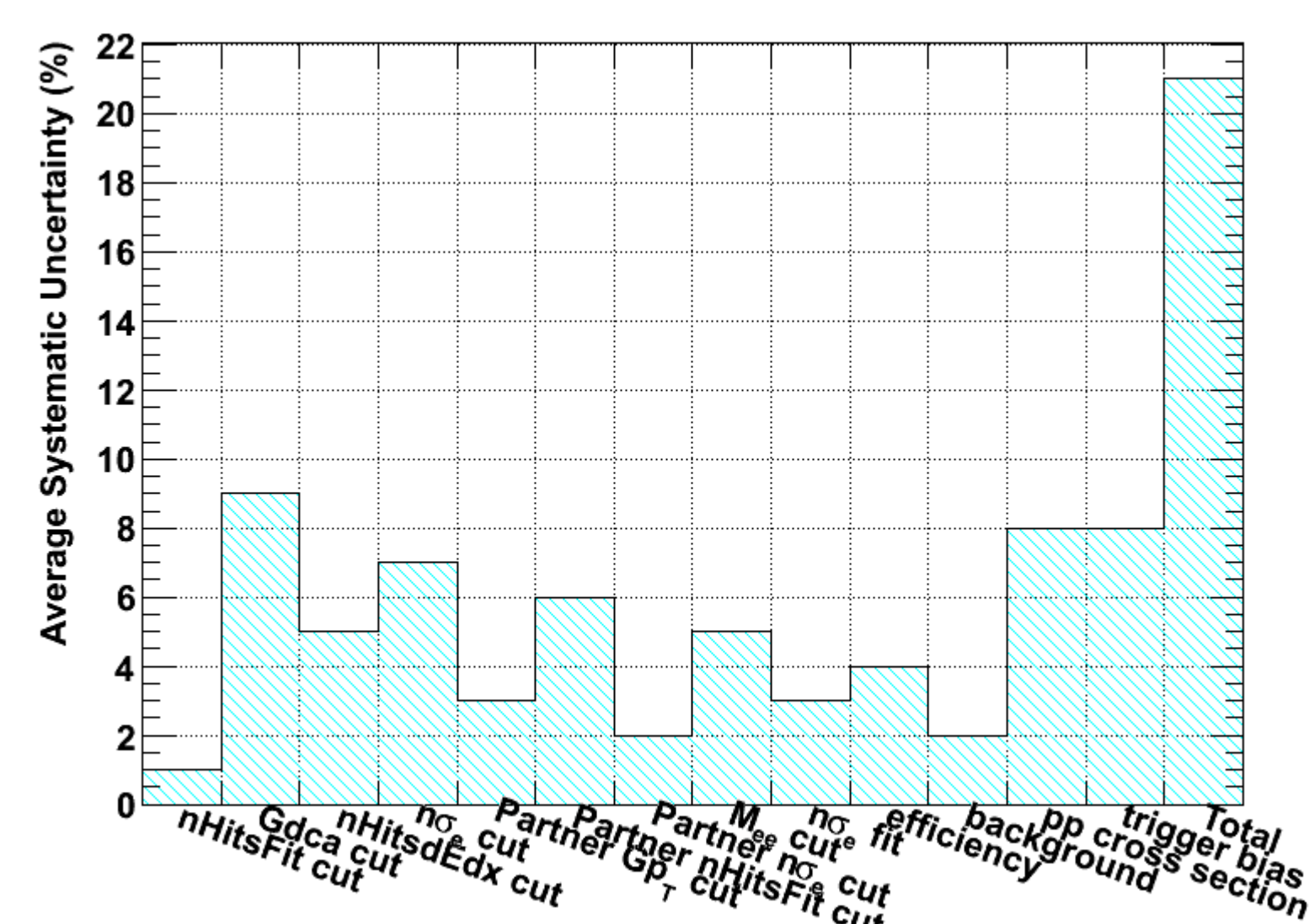


Photonic electron identification



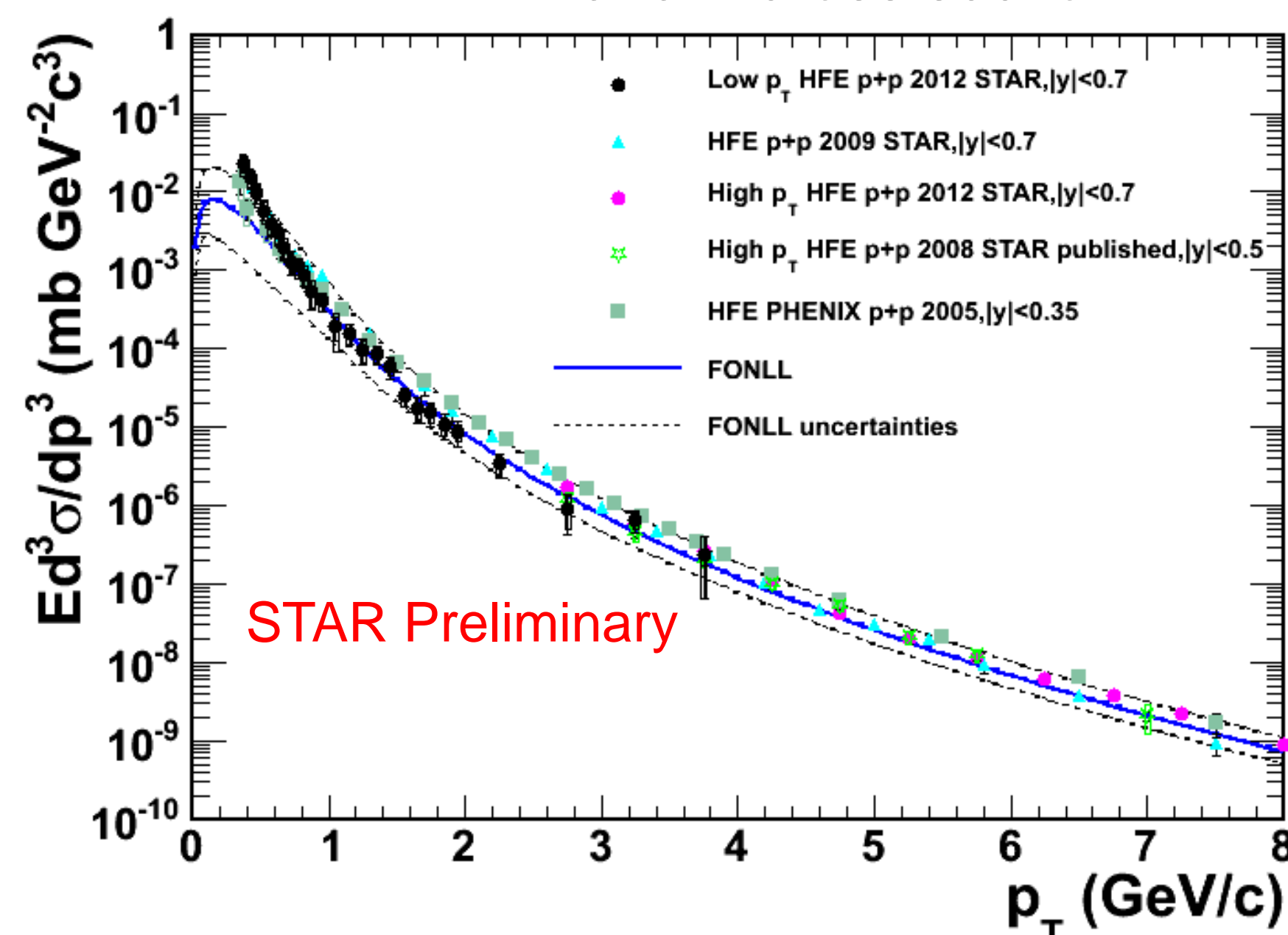
Systematic Uncertainty

- Cuts
- Electron raw yield extraction
- Efficiency
- Background from vector mesons decay

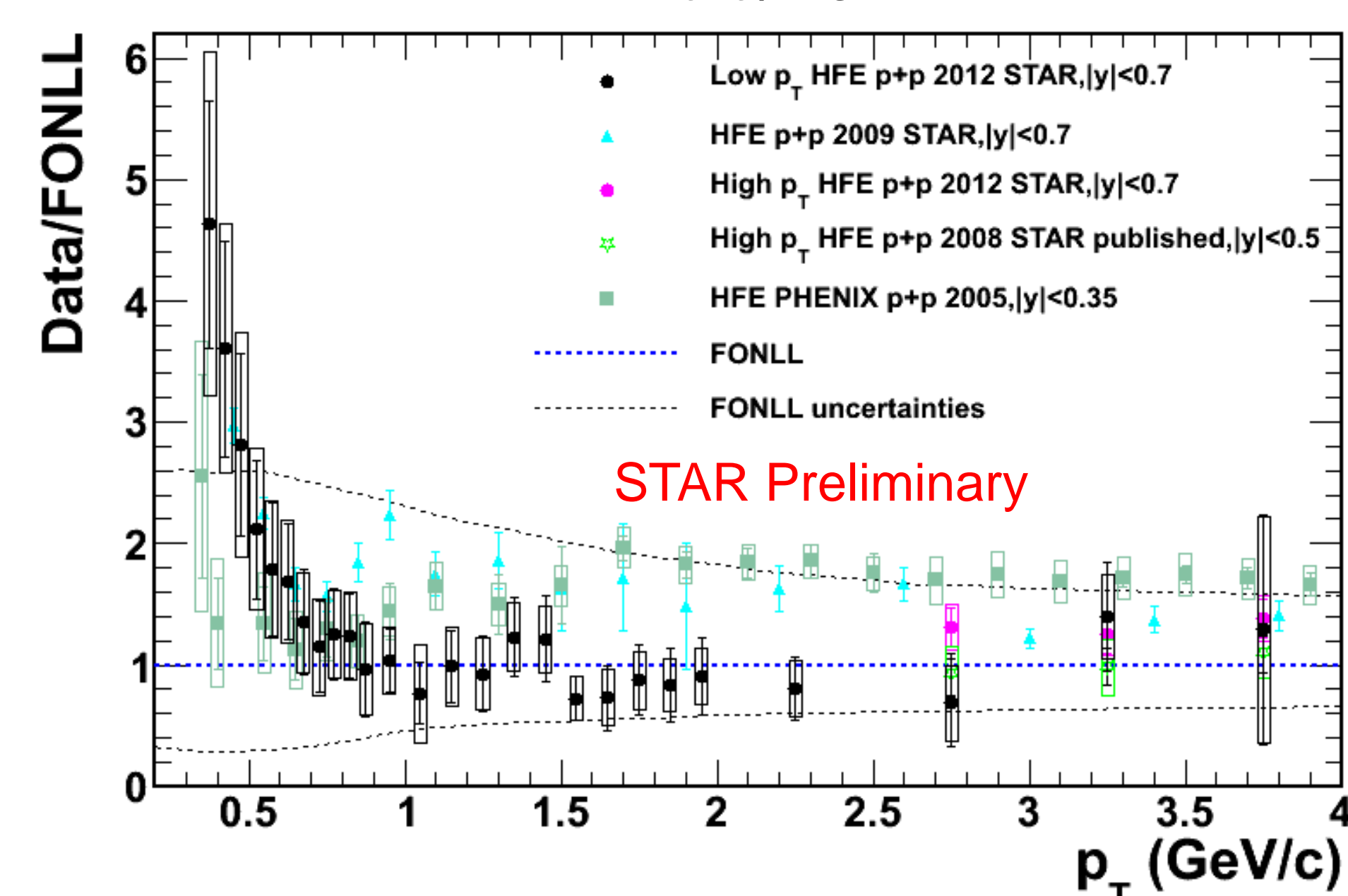


HFE production in p+p 200GeV

HFE invariant cross section



HFE Data/FONLL



- ✓ Spectrum is extended to low p_T and has a better coverage compare to STAR previous published result.
- ✓ Consistent with FONLL calculation.

Summary

- 1) HFE production in the p_T range of 0.35 – 2.5 GeV/c in p + p collisions at $\sqrt{s} = 200$ GeV is measured.
- 2) This measurement provides a reference for Nuclear Modification Factor R_{AA} measurement in heavy – ion collisions.