

A woman with dark hair, wearing a dark sleeveless top, is playing a banjo. She is looking down at the instrument. The background is dark and out of focus.

**Two particle azimuthal correlations in  
Cu+Cu collisions at  $\sqrt{s_{NN}} = 200$  GeV at  
RHIC**

**Christine Nattrass (STAR collaboration)  
Yale University**

Christine Nattrass (STAR Collaboration), Yale University  
DNP, Nashville, 28 October 2006



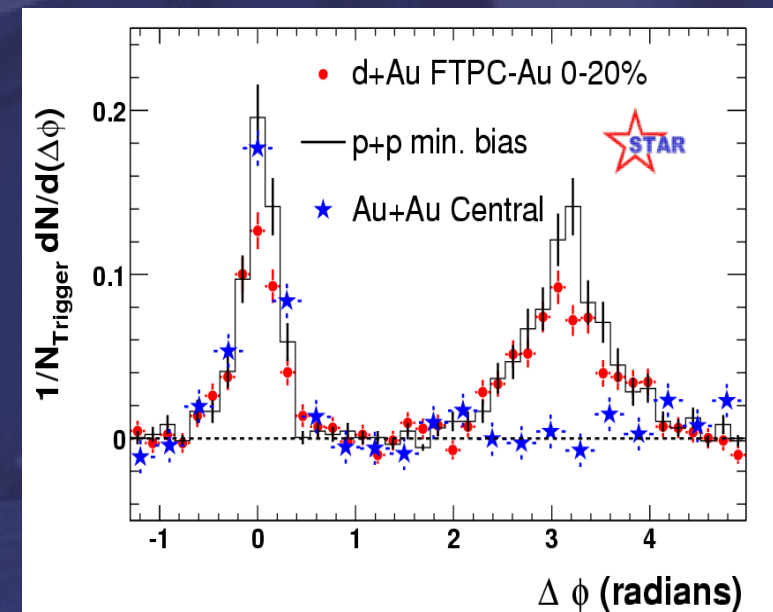
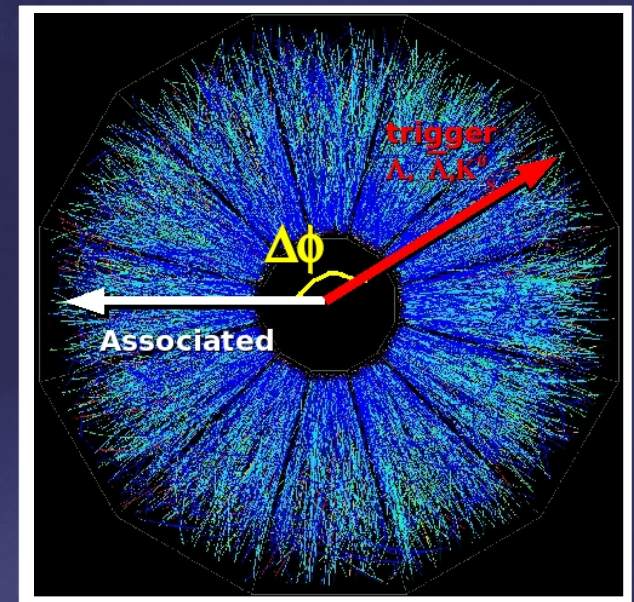
# Outline

- Motivation
- Analysis technique
- Results
- Conclusions

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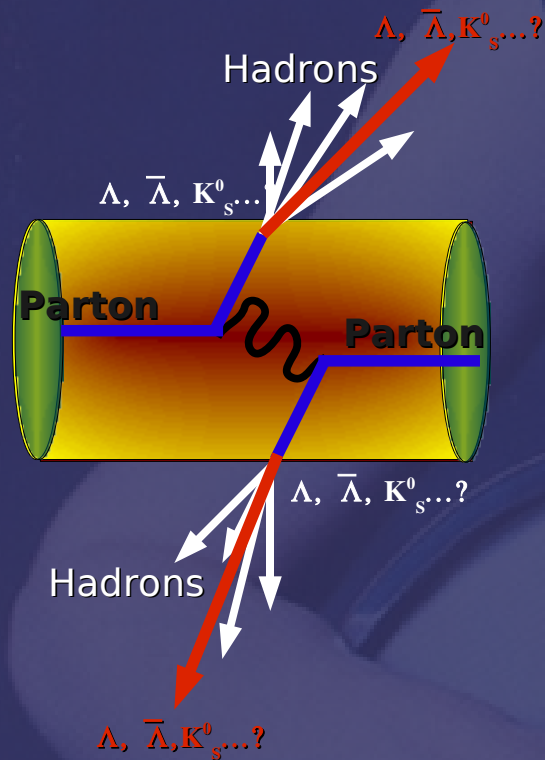
# Motivation – Jets as a probe of the medium

- Hard parton scattering => back-to-back jets
- Good probes of medium produced at RHIC
- High multiplicity in A+A events
  - Individual jets cannot be identified
  - Jets have been studied using azimuthal correlations



STAR, PRL 91 (2003) 072304

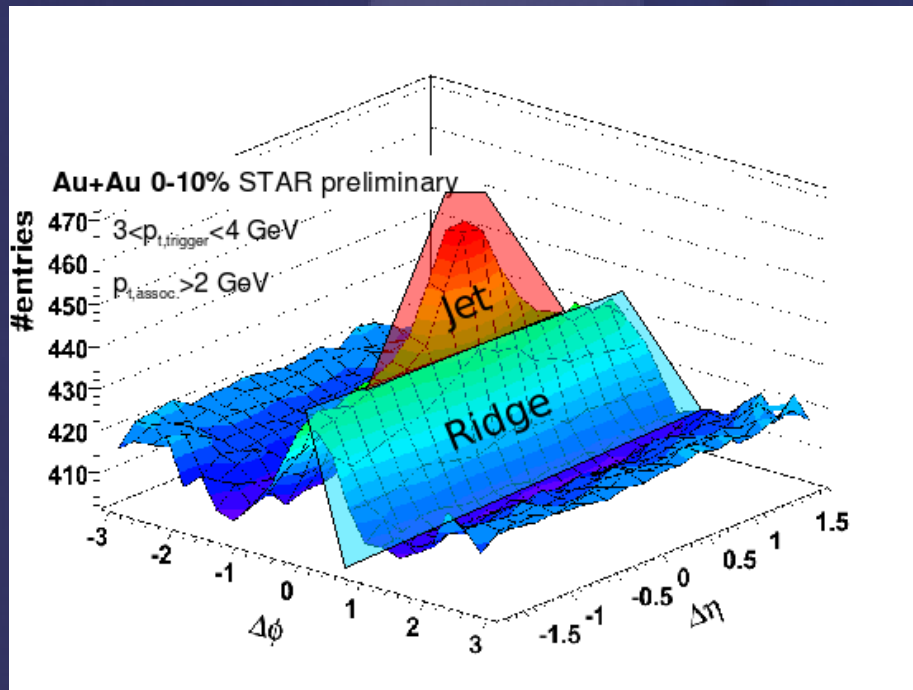
# Motivation – particle identification in jets



- Particle identification:
  - Particle/antiparticle differences
    - Quark vs gluon jets
  - Meson/baryon differences
    - Coalescence/ recombination mechanisms
      - Observed in particle ratios
      - Testable with identified particle correlations?

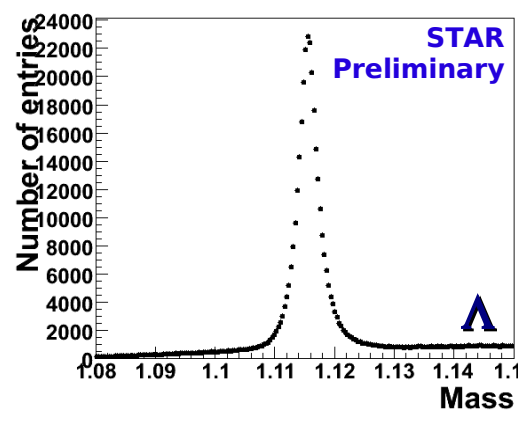
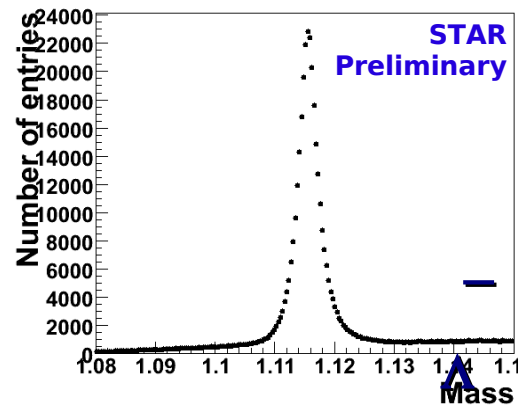
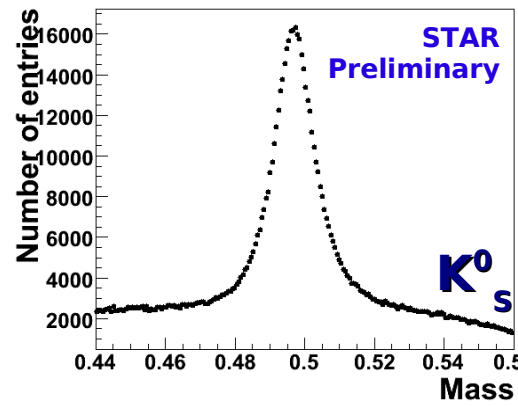
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# Motivation - Long-range pseudorapidity correlations

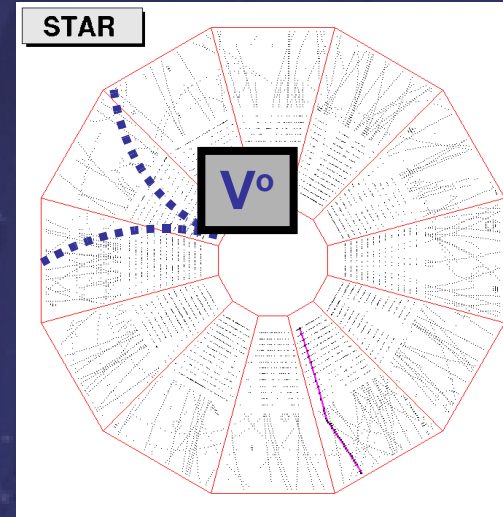


- ▮ Long-range pseudorapidity ( $\eta$ ) correlations observed by STAR in Au+Au
- ▮ Near side jet peak sits on plateau (Ridge)
  - ▮ Significant contribution to the near-side yield
- ▮ Look for particle, system size dependencies which might reveal production mechanism

# Identification of strange particles



- ♪  $V^0$  identification
- ♪ Reconstruction decay vertices
- ♪ Identification out to high  $p_T$
- ♪ Pure samples
- ♪  $V^0$ s used for trigger



$K_S^0$ :  $m_{K_S^0} = .498 \text{ GeV}$ ,  $c\tau = 2.68 \text{ cm}$

$K_S^0 \Rightarrow \pi^+ + \pi^-$  (~69%)

$\Lambda$ :  $m_\Lambda = 1.116 \text{ GeV}$ ,  $c\tau = 7.89 \text{ cm}$

$\Lambda \Rightarrow \pi^- + p$  (~64%)

$\bar{\Lambda}$ :  $m_{\bar{\Lambda}} = 1.116 \text{ GeV}$ ,  $c\tau = 7.89 \text{ cm}$

$\bar{\Lambda} \Rightarrow \pi^+ + \bar{p}$  (~64%)

# Results

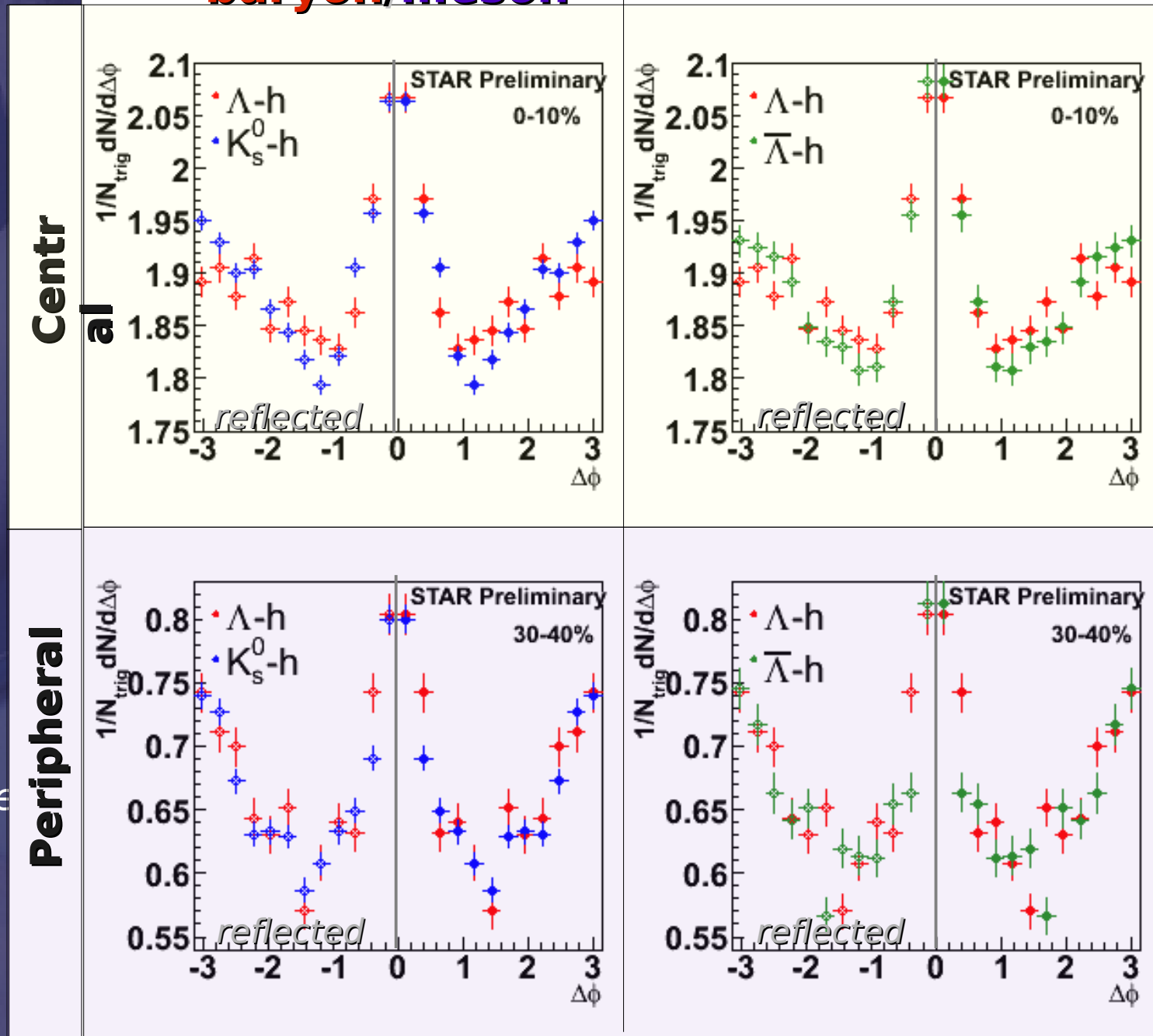
Within errors, no significant difference between

- Meson and baryon
- Particle and antiparticle

$Cu+Cu @ \sqrt{s}_{NN} = 200 \text{ GeV}$   
 $3.0 < p_{T \text{ trigger}} < 6.0$   
 $1.5 < p_{T \text{ assoc}} < p_{T \text{ trigger}}$   
 $-1 < \eta < 1$

**baryon/meson**

**particle/anti-particle**



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# Results

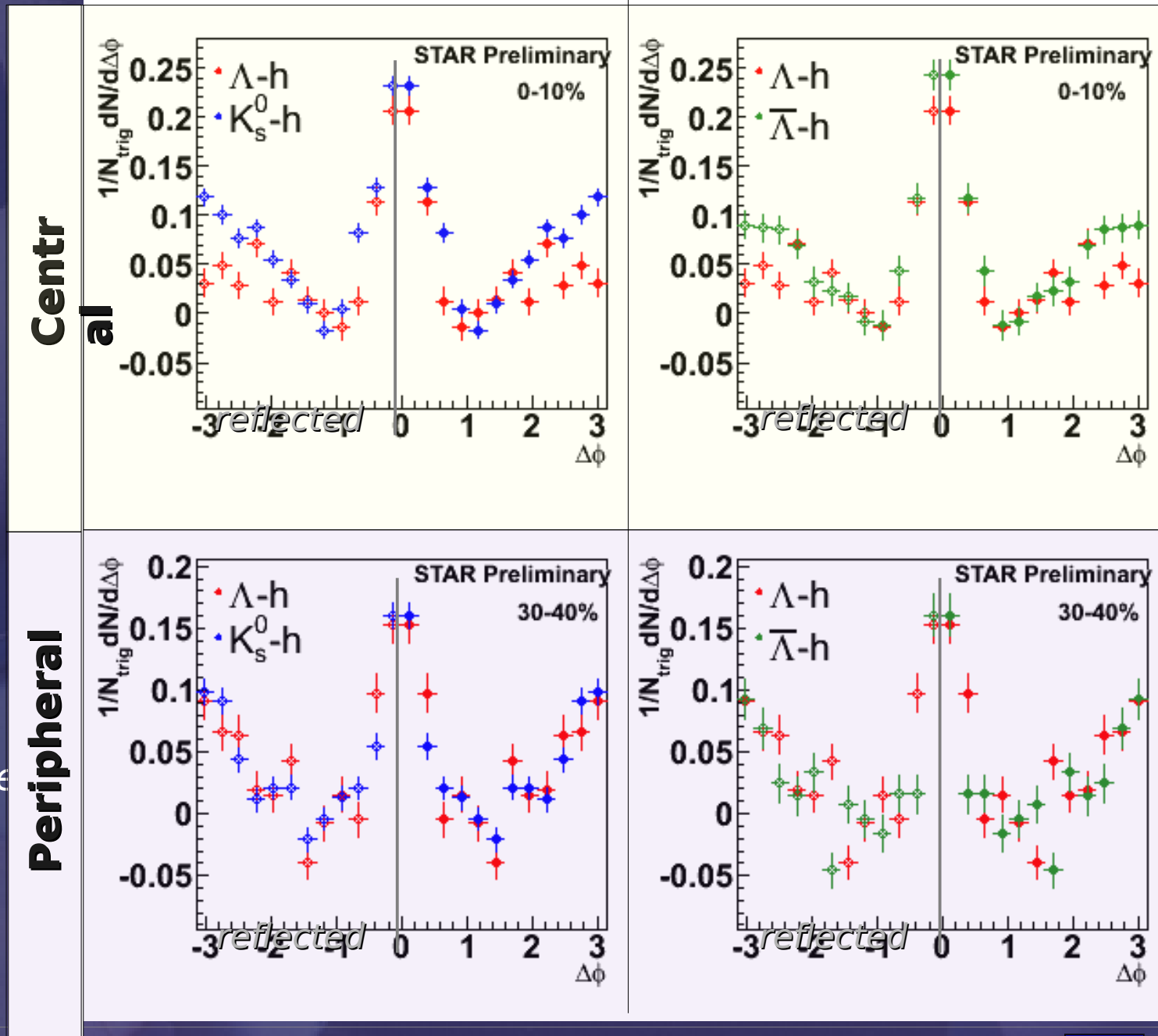
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- Background (combinatorial + flow)

$$B(1 + 2v_{2(\text{trigger})} v_{2(\text{assoc})} \cos(2 \Delta\phi))$$

- Sources of systematic error:

- Different methods:

- Fit

- Assume zero yield at minimum (ZYAM)

- Use one bin for minimum

- Use a few bins for minimum

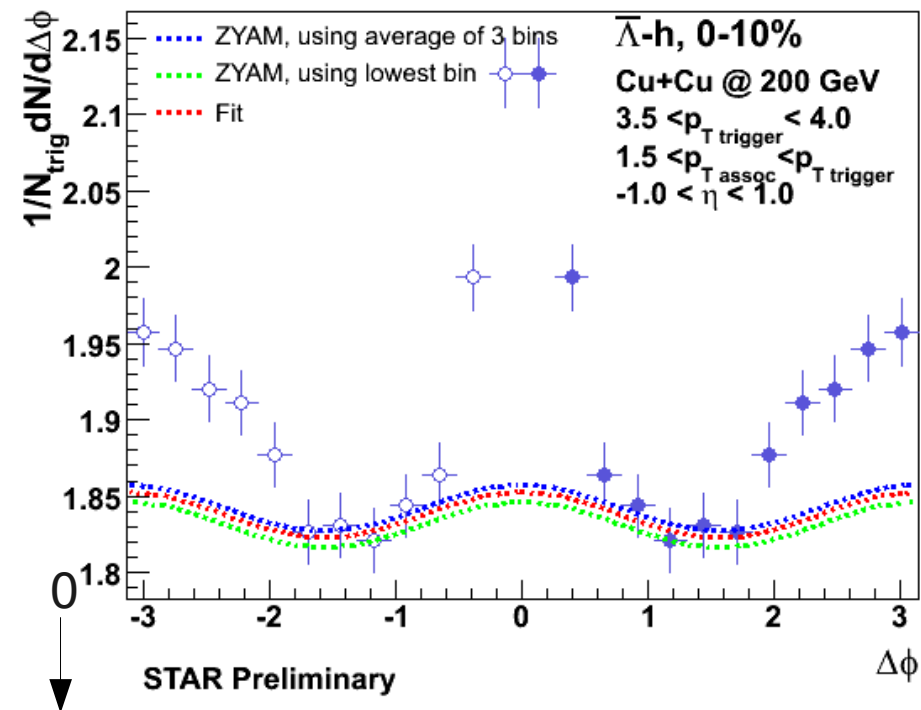
- Error in  $v_2$

- Used  $v_2$  {CuCu-pp}

- Systematic and random errors in  $v_2$

- $v_2$  larger in peripheral collisions

# Background subtraction



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20-30% systematic error in near side yields



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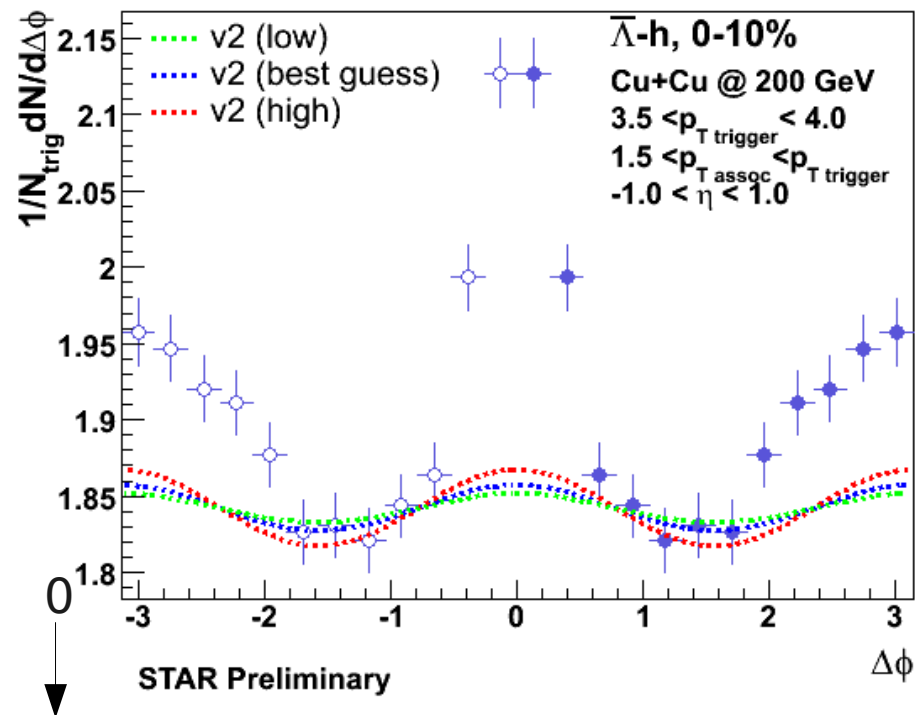
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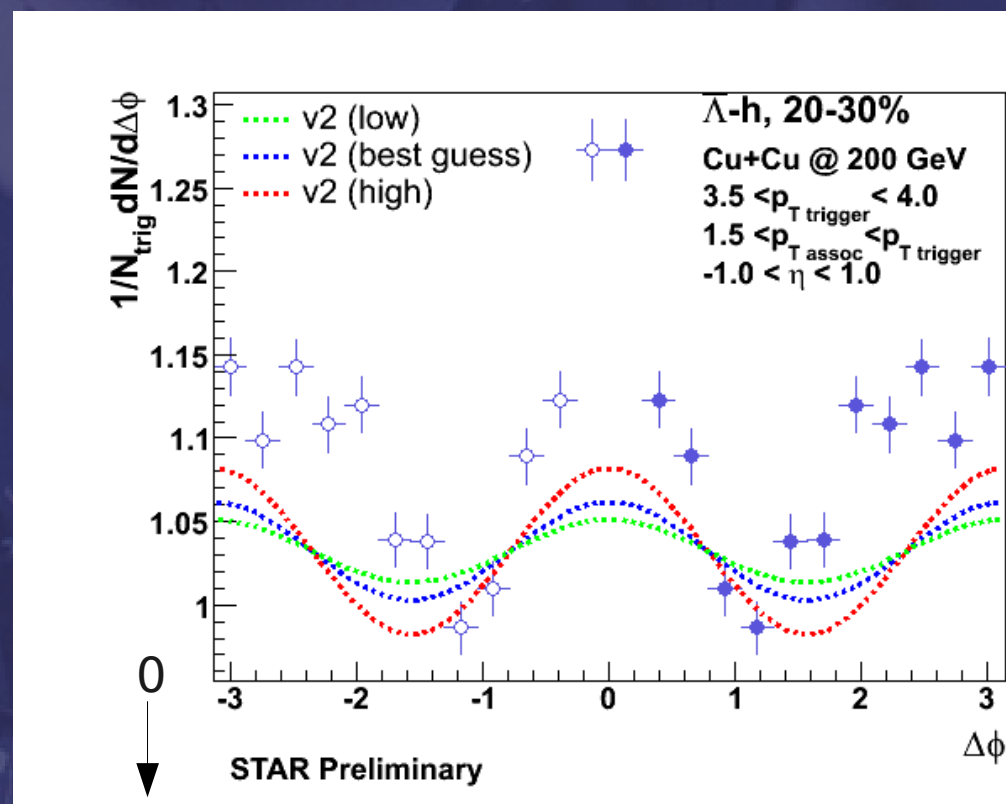
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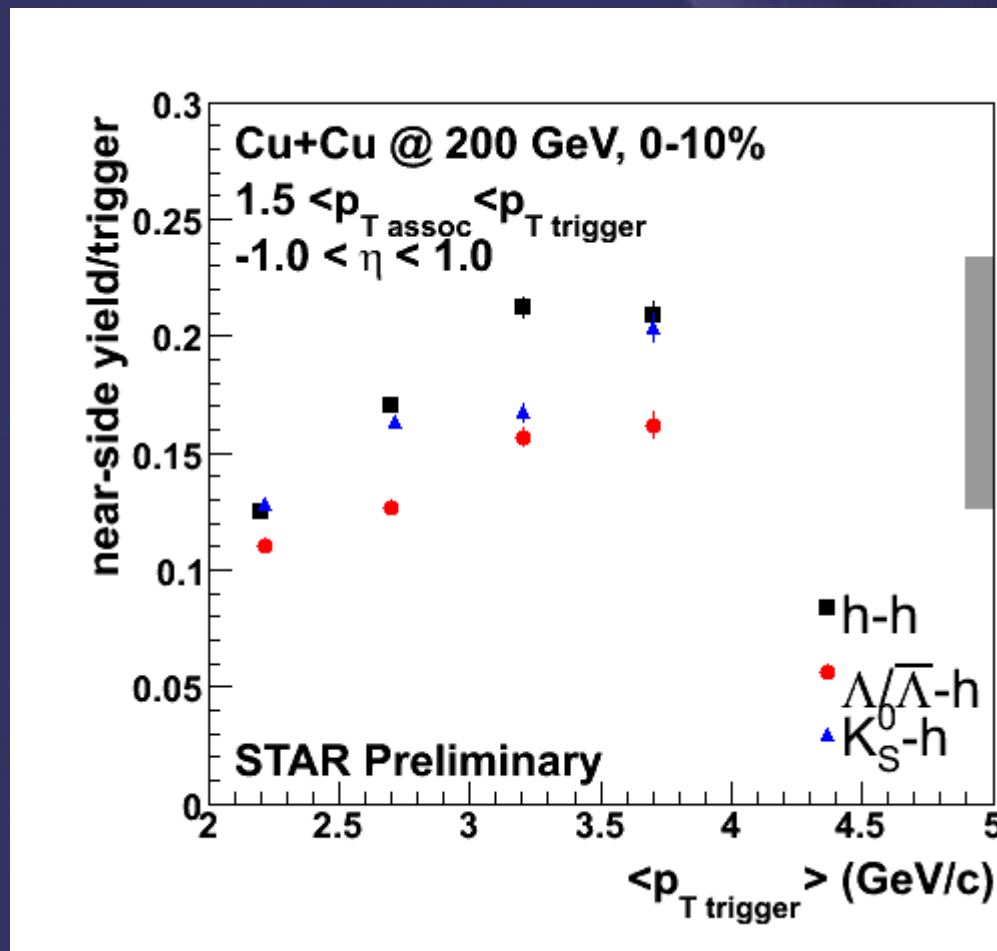
- Systematic and random errors in  $v_2$

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# Background subtraction



# Results – Near-side yields

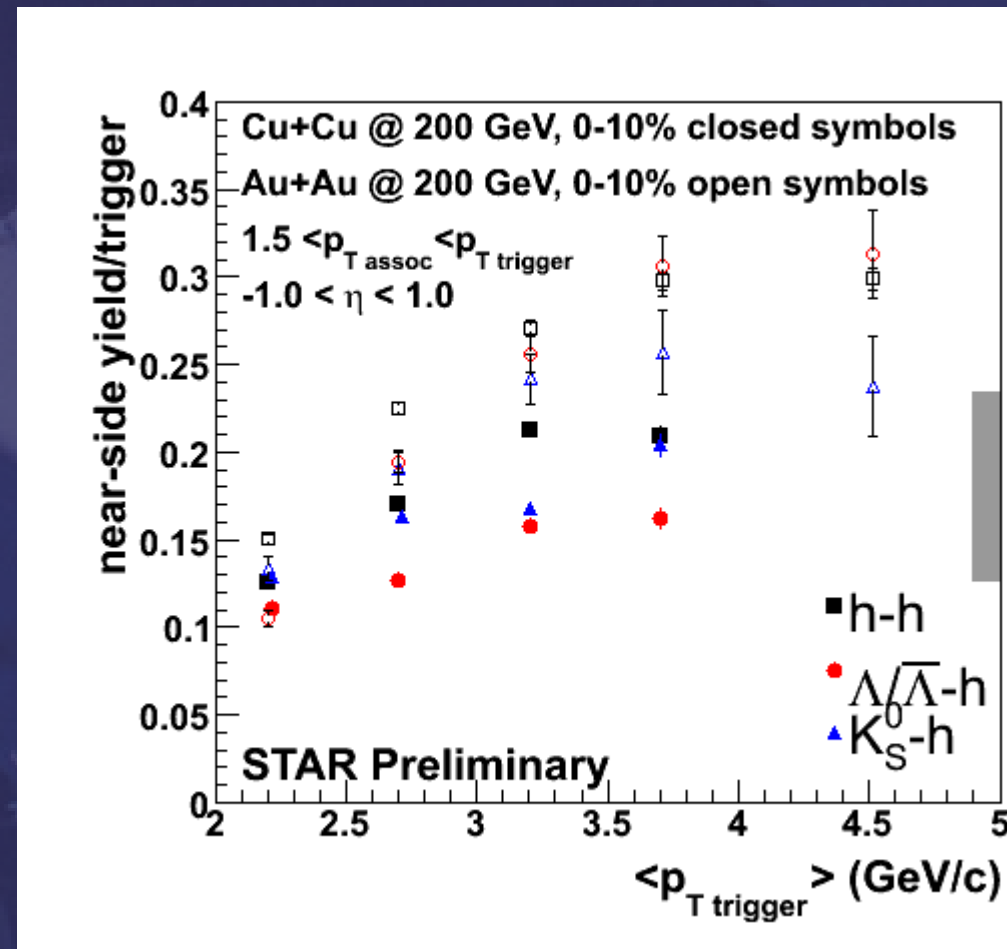


- ZYAM (3 points) used
- No strong particle type dependence
  - Systematic errors may be particle type dependent
- Yield rises with  $p_T$

# Results -

## Comparison to Au+Au

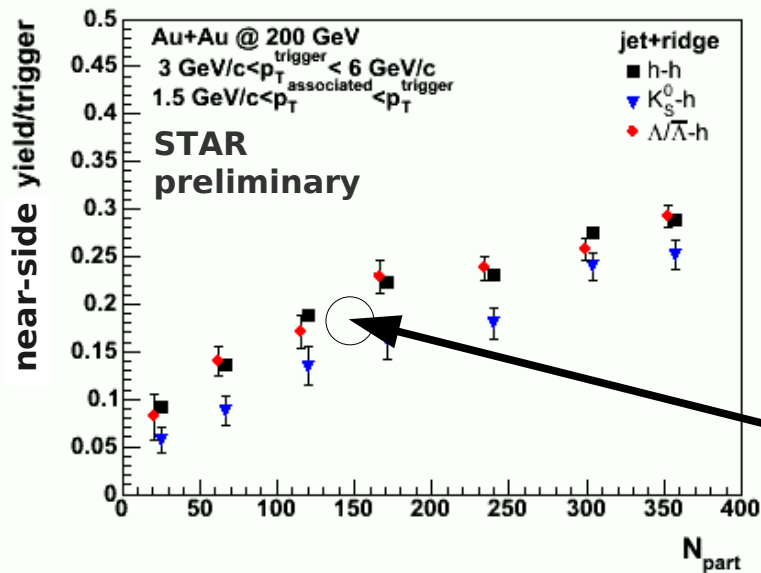
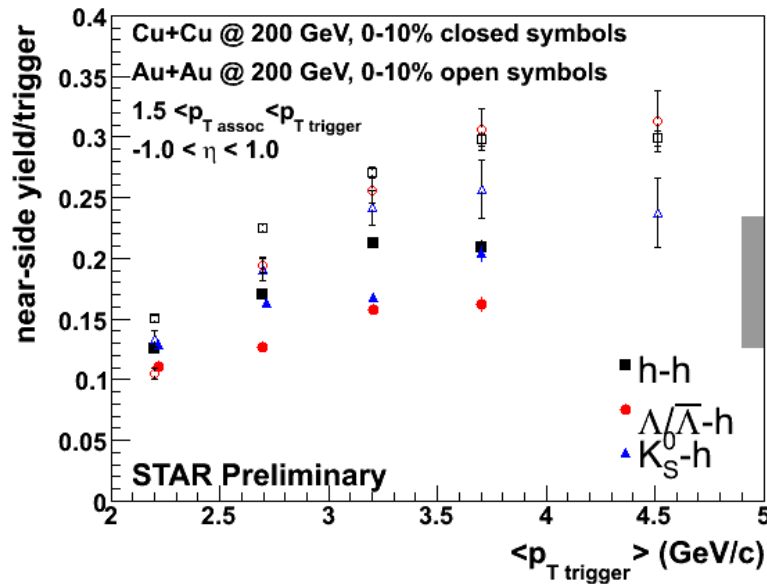
- Cu+Cu similar to Au+Au
  - 🎵 Yield increases with  $p_{T \text{ trigger}}$
  - 🎵 No significant particle type dependence
- Significant ridge yield in Au+Au
  - 🎵 Investigations of Ridge vs Jet yield in Cu+Cu necessary



# Results - Comparison to Au+Au

- Yields in Cu+Cu consistent with Au+Au at similar  $N_{part}$
- Cu+Cu can be used for studying jet and ridge yield at low  $N_{part}$

**Cu+Cu 0-10%**



# Conclusions

- Near-side yield trends similar to Au+Au
  - Yield rises with  $p_{T \text{ trigger}}$
  - Yield is dependent on  $N_{\text{part}}$
  - No significant difference between
    - Meson /baryon triggers
    - Particle /antiparticle triggers
- Ridge is a major contribution to near-side yield in Au+Au
  - Ridge contribution in Cu+Cu needs to be investigated

# Work to come...

- $\Delta\phi$ - $\Delta\eta$  correlations in Cu+Cu
  - Jet vs Ridge yield comparisons
- $V^0$  associated particles (unidentified triggers) in Cu+Cu
  - Study composition of ridge
- Multistrange trigger particles ( $\Xi^+$ ,  $\Xi^-$ ,  $\Omega^+$ ,  $\Omega^-$ ) in Cu+Cu
  - Test recombination model

■ **See Jana Bielcikova and Jörn Putschke's talks at Quark**

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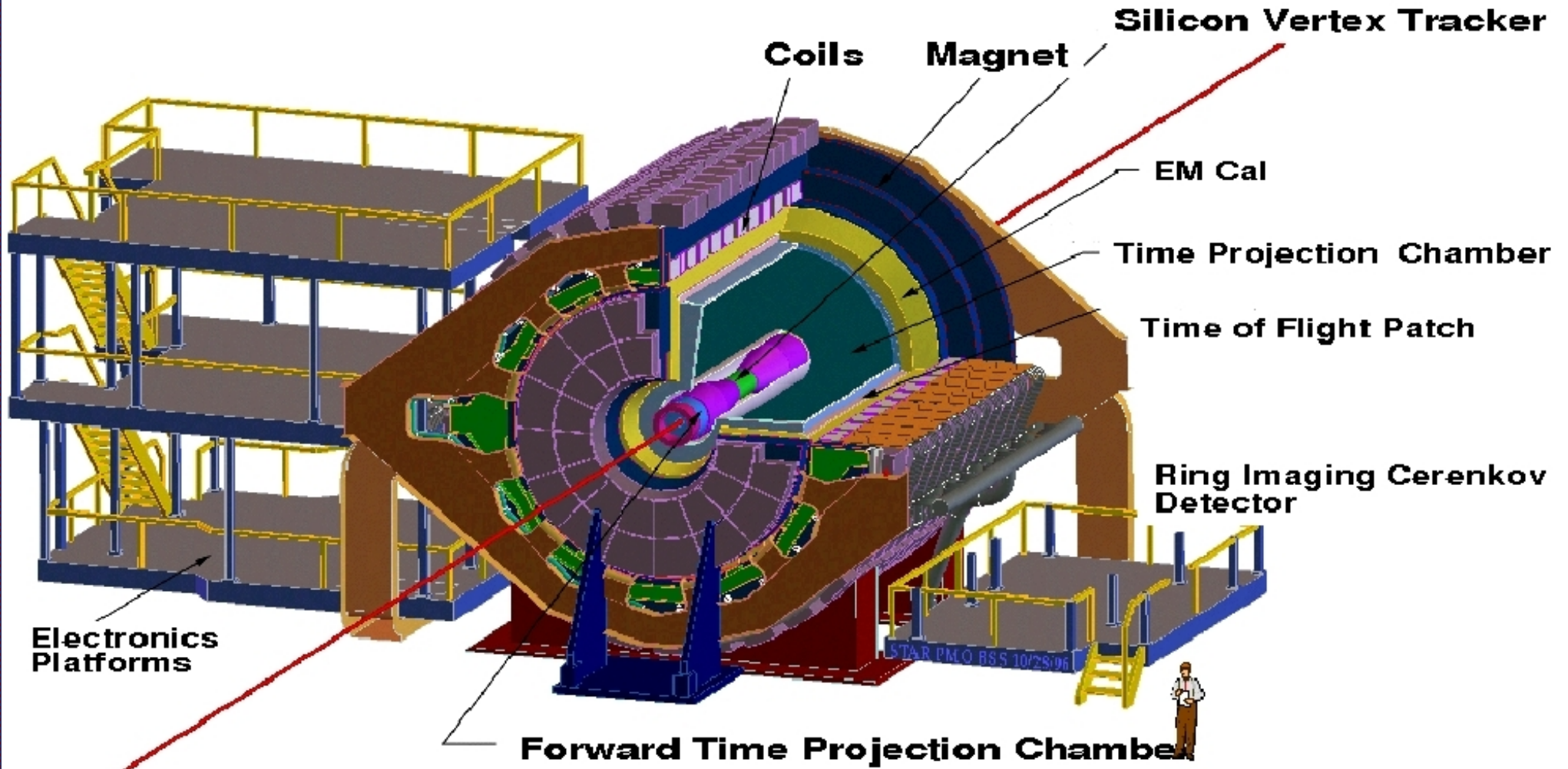
**Matter!**



# Backup slides

Christine Nattrass (STAR Collaboration), Yale University  
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**"Large acceptance hadronic detector"**



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DNP, Nashville, 28 October 2006