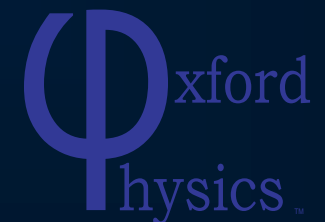


Strange Particle Production at the ZEUS detector

IoP 2005

Andrew Cottrell



Contents

- Strange Particles – are they interesting?
- How to measure them at ZEUS
- Results

Strange Particles

$$\Lambda \rightarrow P \pi^{-}$$

Baryon

$$\overline{\Lambda} \rightarrow \overline{P} \pi^{+}$$

Antibaryon

$$K_s^0 \rightarrow \pi^{+} \pi^{-}$$

Meson

- Low Mass
- High Statistics
- Clean Signal

Why measure them?

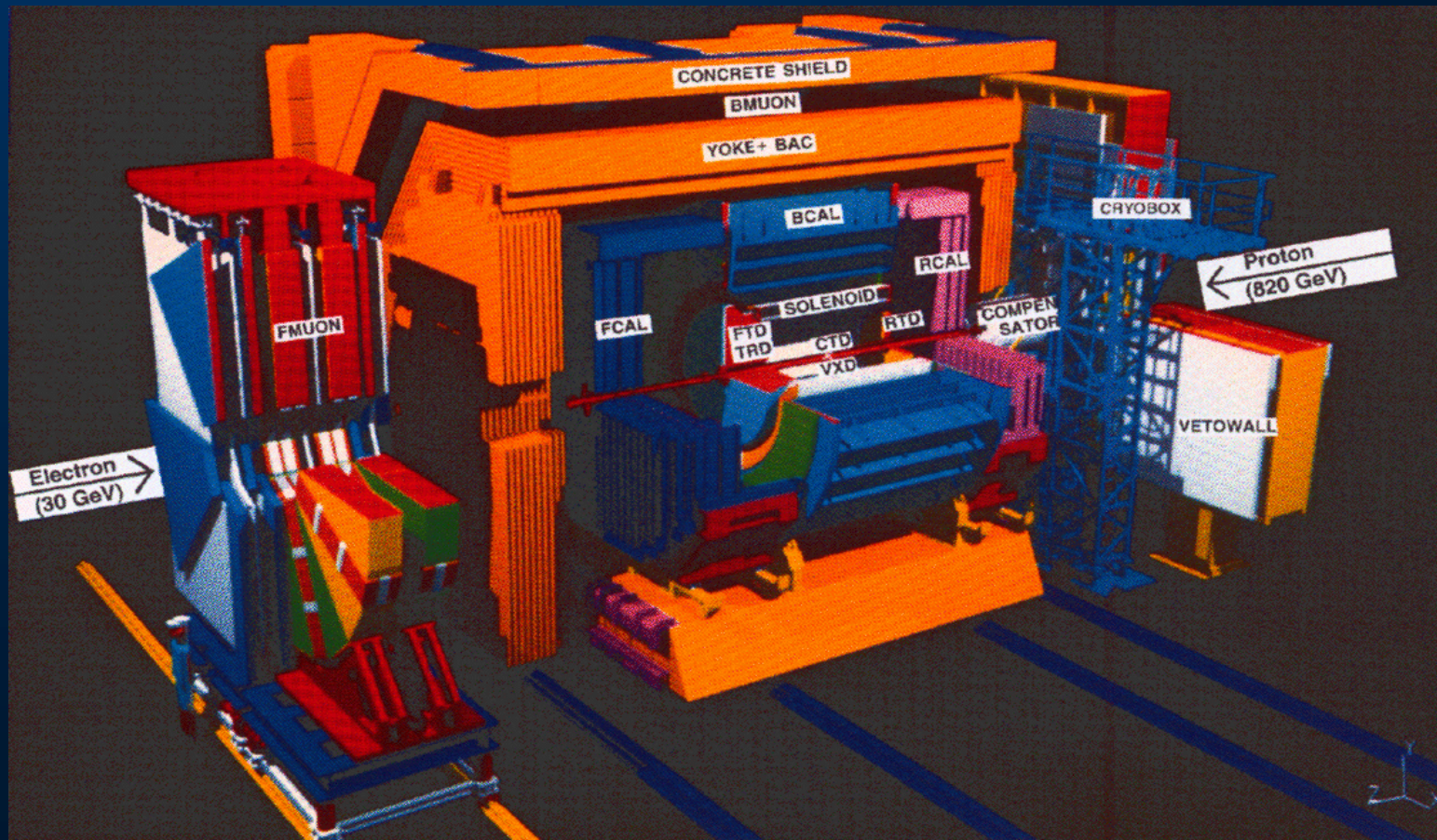
- Where is strange quark coming from?
 - Lambda Polarization
- What carries Baryon Number?
 - Lambda-Antilambda Asymmetry
- How are Baryons and Mesons formed?
 - Lambda- K_s^0 Ratio



How do Quarks become Hadrons?

ZEUS

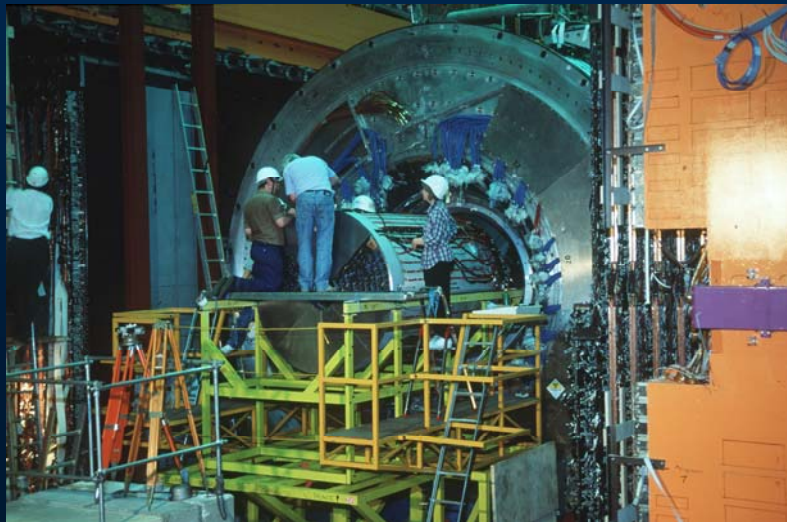
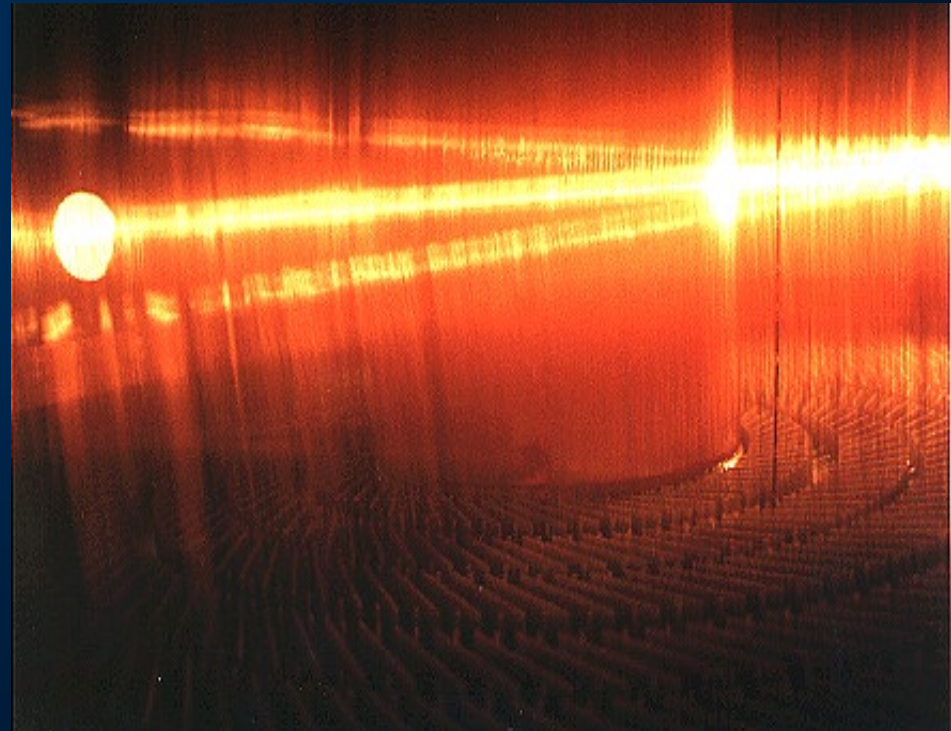
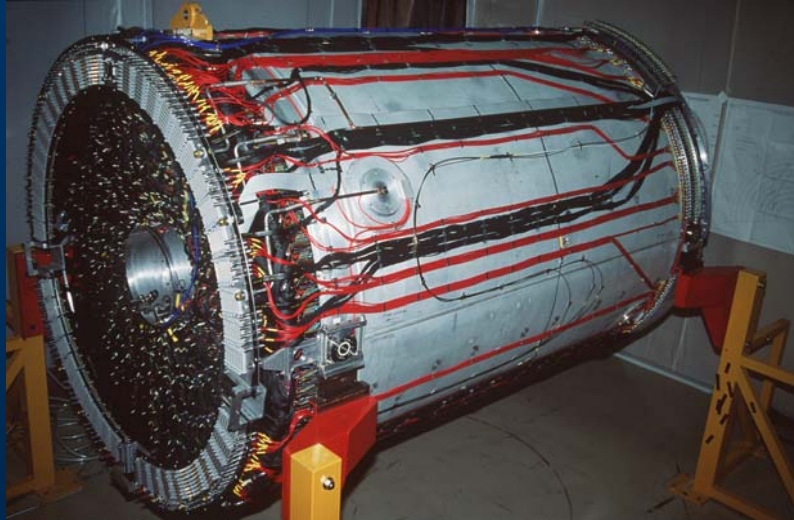
- HERA: 27.5 GeV e^+ on 920 GeV Protons
- 2 General Purpose Detectors, H1 and ZEUS



Detection

- Central Tracking Detector
- Multi-wire Drift Chamber
 - 4608 Sense Wires
 - 19584 Field Wires
 - Arranged into 9 ‘Superlayers’
 - 5 Parallel to beam axis
 - 4 at 5° to beam axis to give good z-resolution
 - Resolution $\sim \sigma(P_T)/P_T = 0.0058P_T + 0.0065 + 0.0014/P_T$
- Magnetic Field 1.43 Tesla

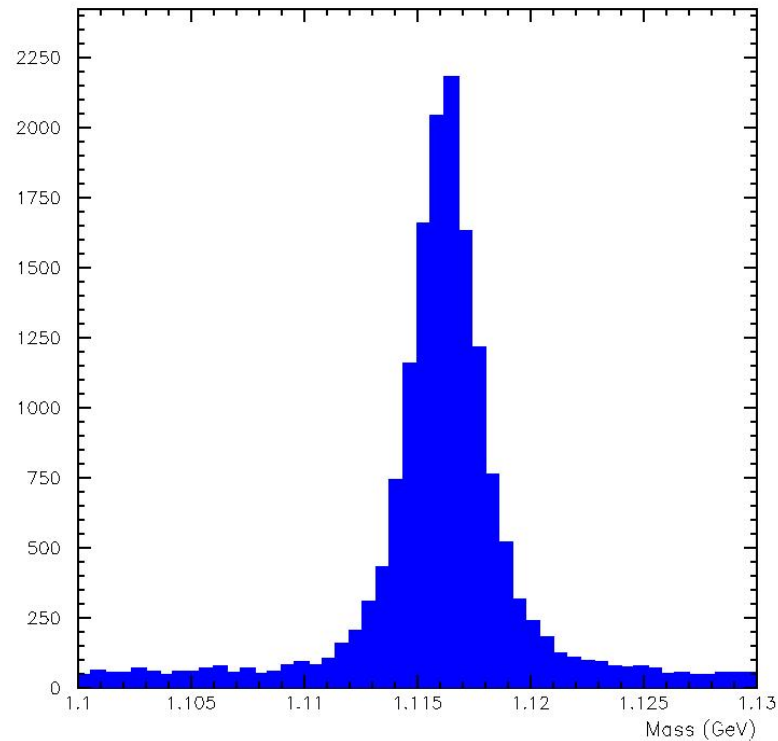
CTD Pictures



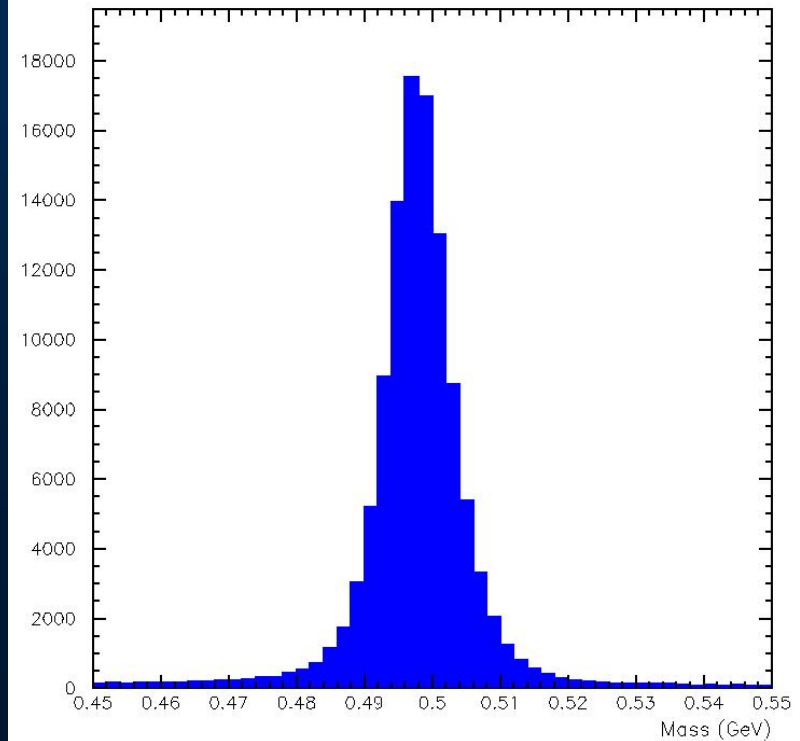
Signals

- Find Secondary Vertex
- Require Well-Measured Tracks
- Reconstruct Invariant Mass

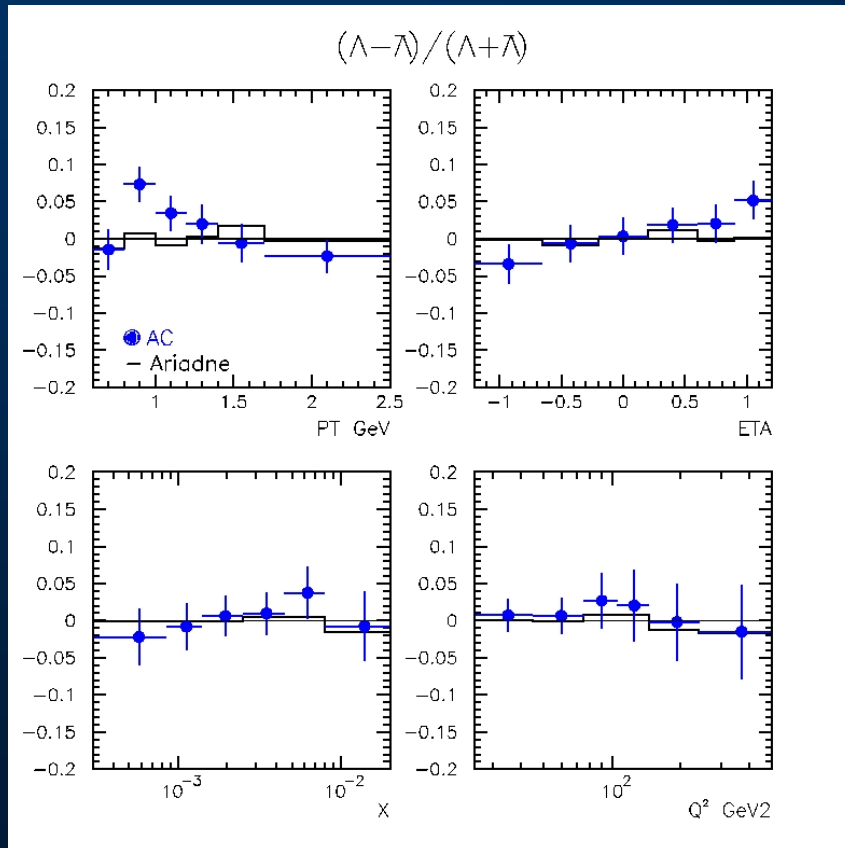
$\Lambda + \bar{\Lambda}$ Mass Peak



K_s^0 Mass Peak



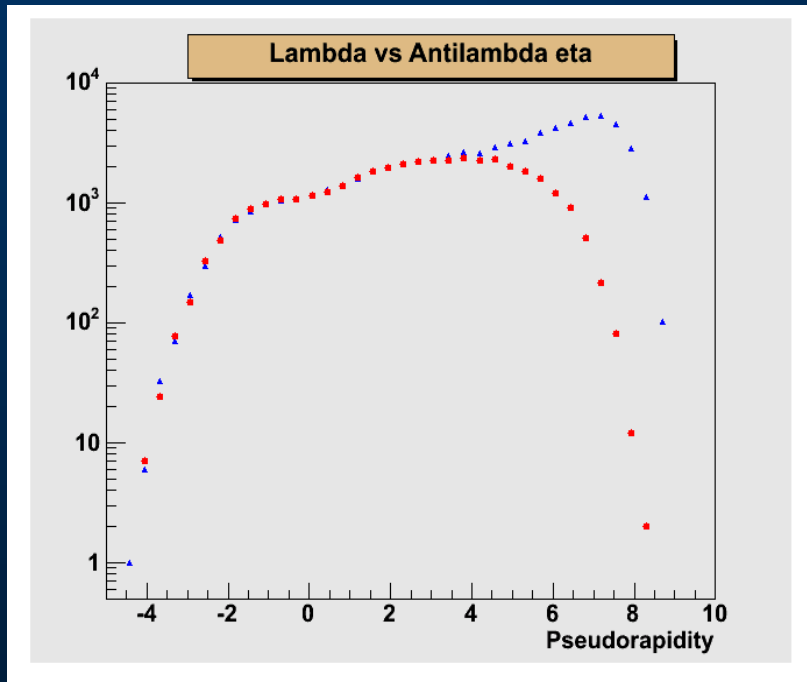
Results – Baryon Asymmetry



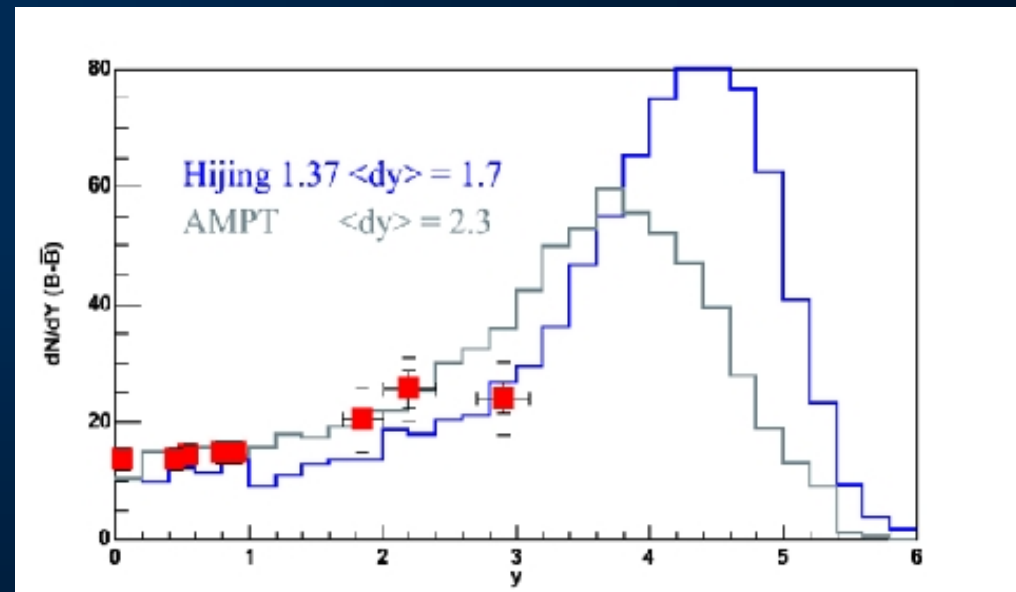
- Slow rise as a function of η
 - More Baryons closer to proton direction
- What carries the Baryon Number?
 - Valence Quarks
 - Gluon Junctions

Other views on Baryon Asymmetry

- Monte Carlo



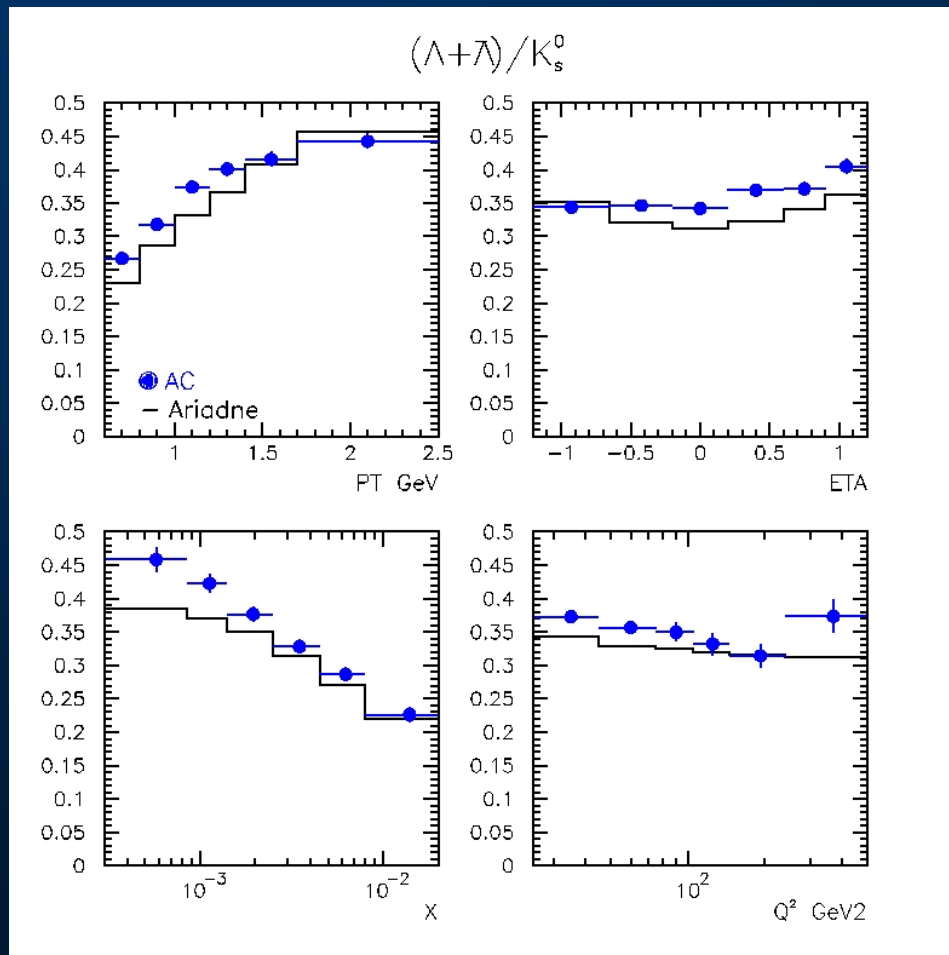
- Heavy Ions



(F. Videbaek, BNL)

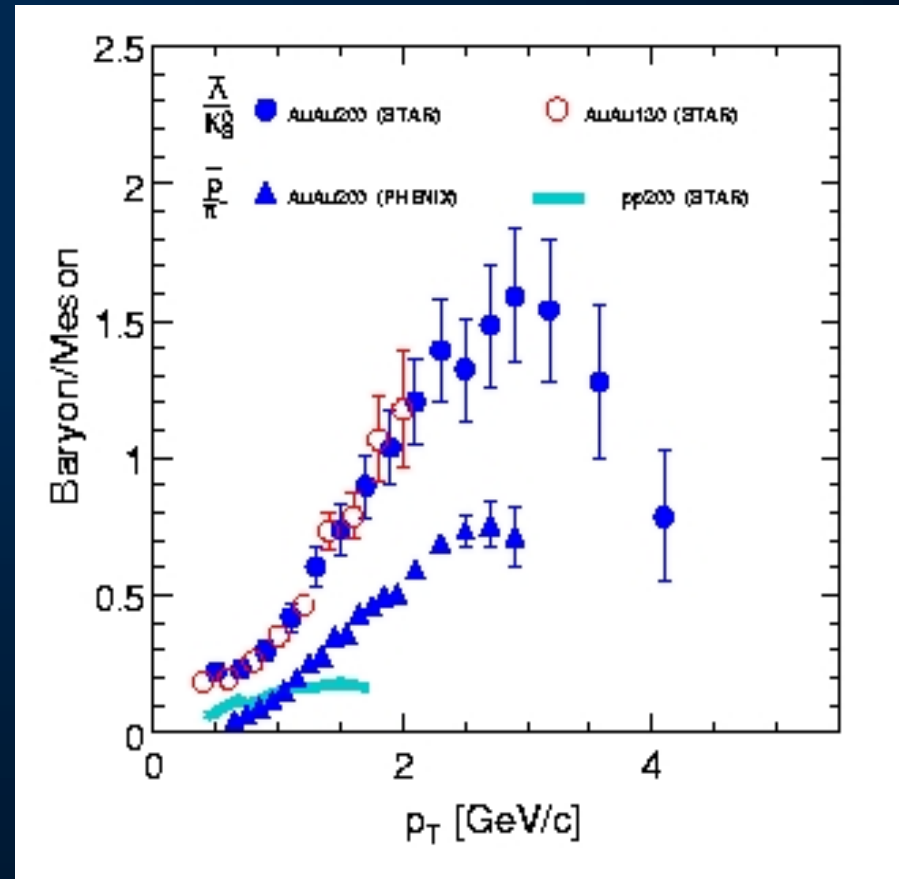
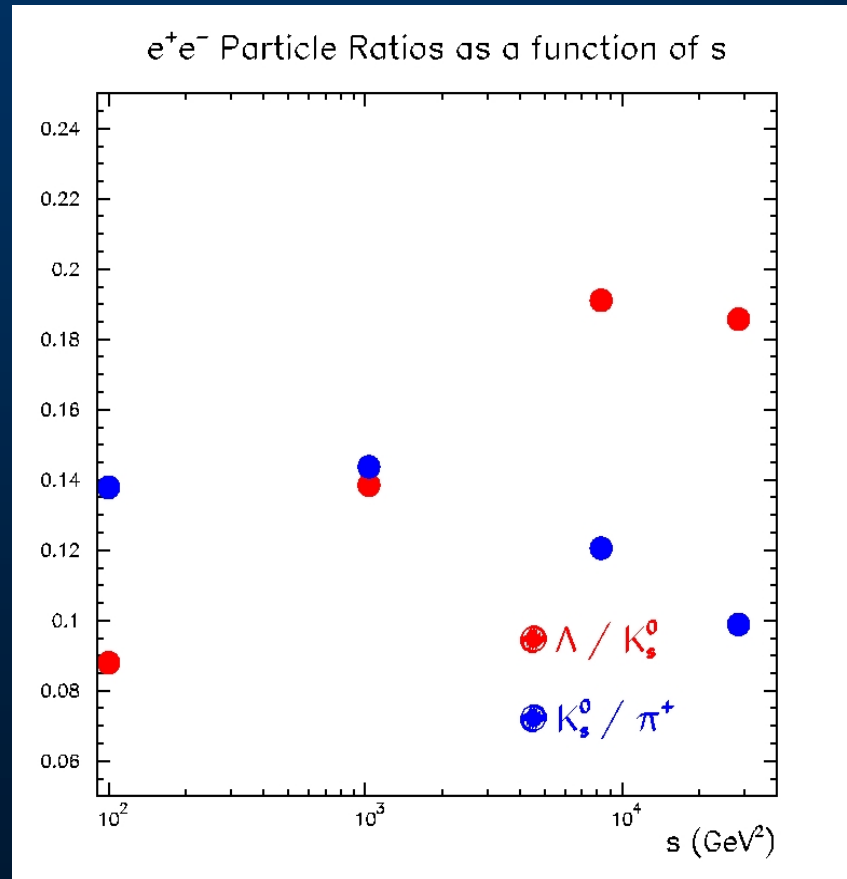
- **LHC?**

Results – Baryon to Meson Ratio



- More likely to get Baryon at low x and high P_T
- Passable agreement between data and MC – Coincidence?

Other Views on Baryons and Mesons

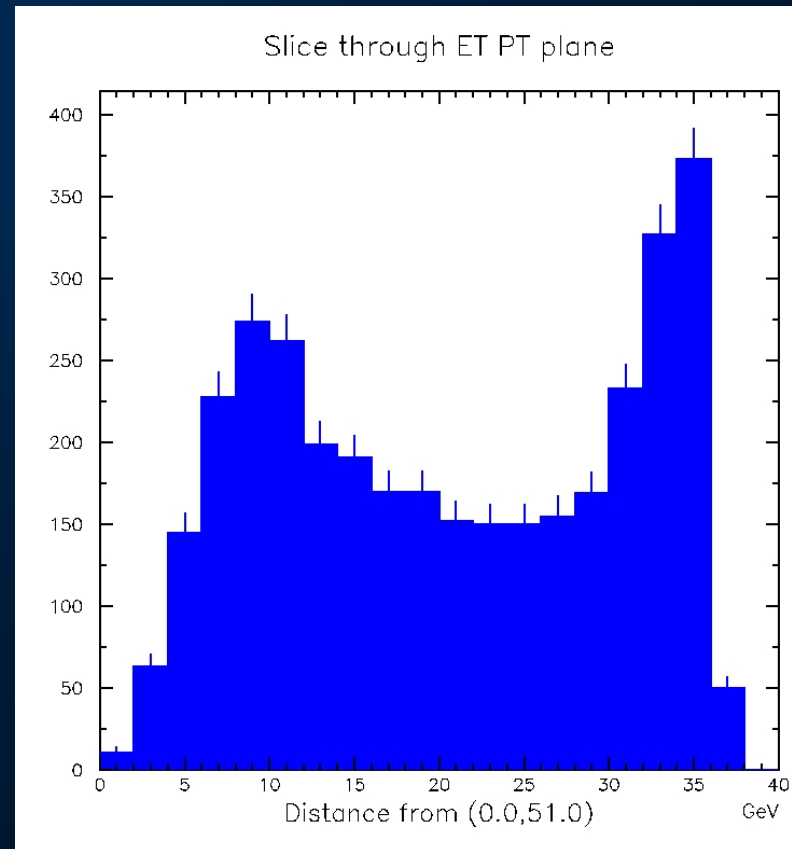
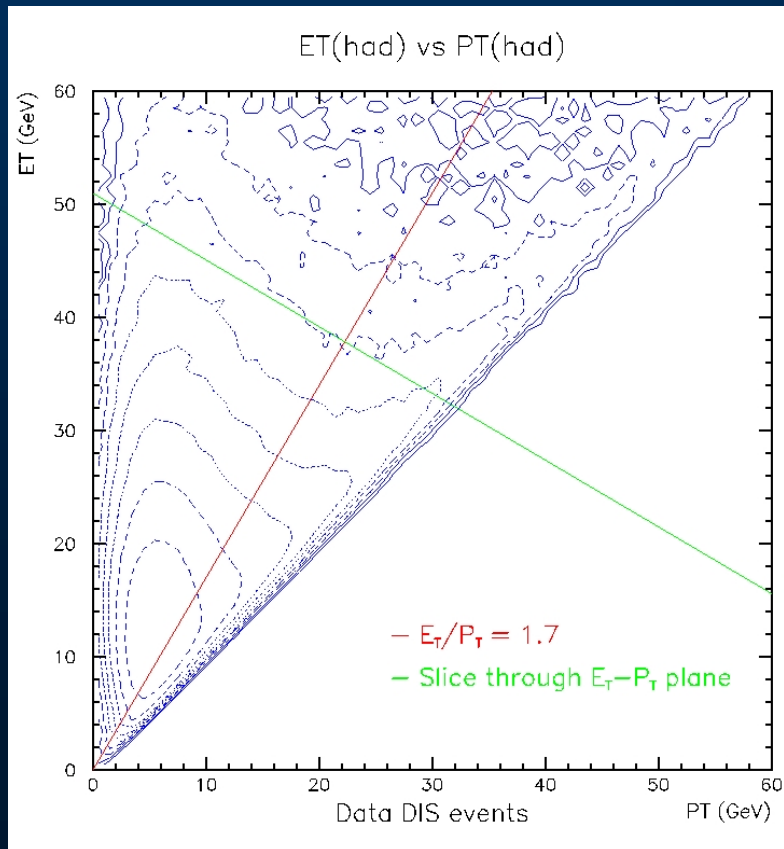


(nucl-th/0306027)

2 E_T - P_T regions

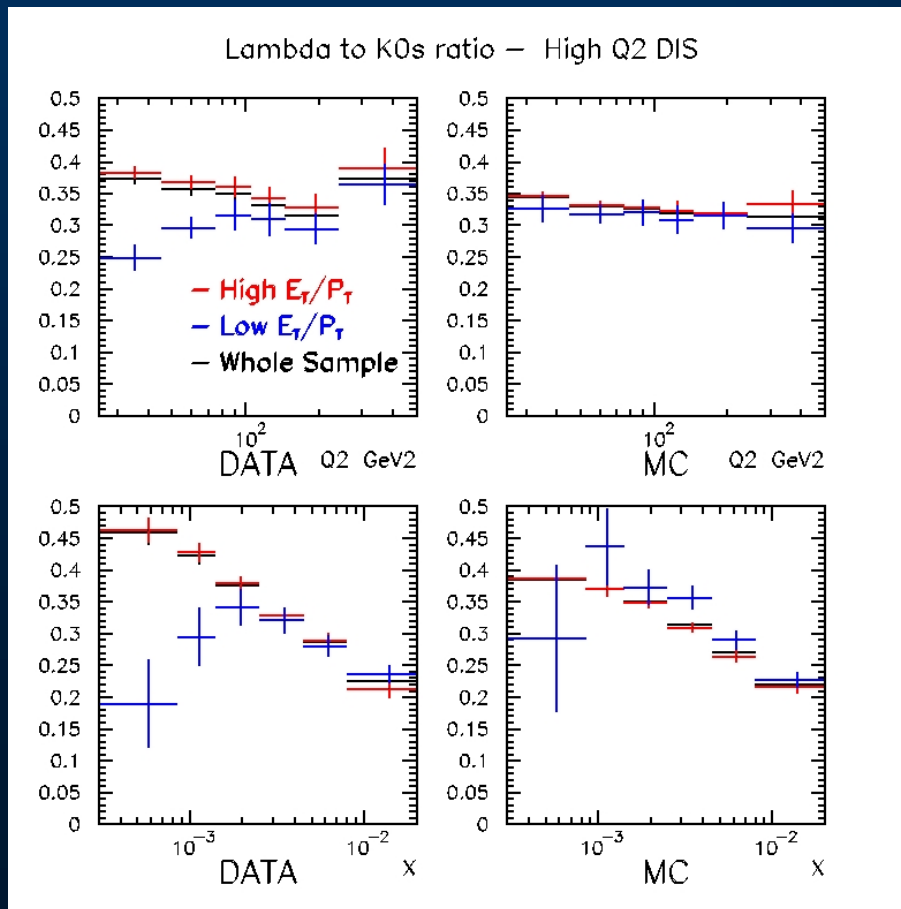
Hadronic Transverse Energy: Scalar vs Vector Sum

➤ Single-Jet Events vs Multi-Jet Events



Baryon to Meson Ratios

Compare High ET/PT events with Low ET/PT events



- Different shapes for Multi-Jet and Single-Jet events in Q^2
- Not well-simulated in MC
- Is the Physics Q^2 or x driven?

Conclusions

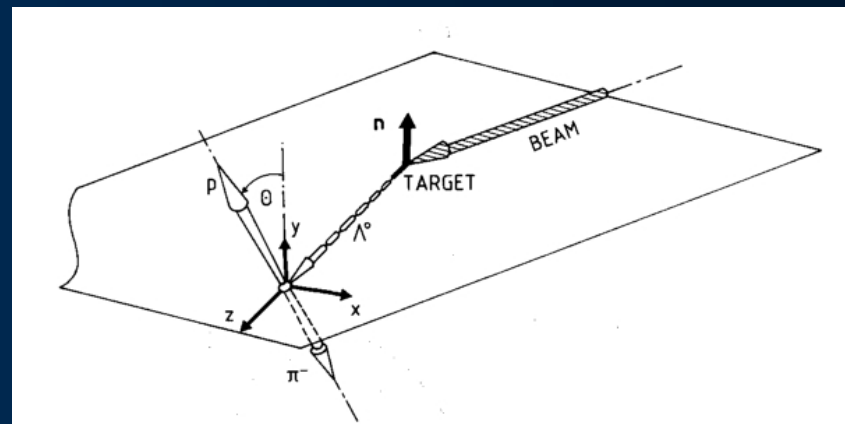
- **Conclusion:**
 - Studied Baryon and Meson Production with Λ and K_s^0 in DIS at ZEUS
- **Future Work:**
 - Photoproduction and Very Low Q^2
 - Correlations
 - Instantons!

Results - Polarization

- Polarization is preference of Λ spin for a particular direction
- Expect Λ spin mainly carried by s-quark
- s-quark can become polarized by Thomas Precession when accelerated
- Therefore, Λ Polarization gives information on initial whereabouts of s-quark
 - Proton beam?
 - Electron beam?
 - Hadronization?

Results - Polarization

- Measure Polarization by observing decay proton direction



$$\frac{dN}{d\Omega} = \frac{1}{4\pi} (1 + \alpha P^\Lambda \cos \theta)$$

- Λ : -0.3% +/- 4.5%
- $\bar{\Lambda}$: 0.8% +/- 4.4%
- K_s^0 : -1.8% +/- 1.2%

