REPORT ON PAIR SYMMETRIC BACKGROUND

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Pair symmetric background

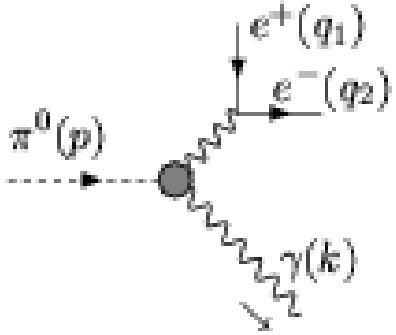
- Pair symmetric processes create a background to inclusive electron scattering
  - -Target background for SANE is mostly from e^+e^- pairs

- BETA is charge sign insensitive → both e+ and e- from pair processes has to be taken into account

- Lepton pair production from bremsstrahlung photons is negligible for SANE

- Main background is from π^0 decay

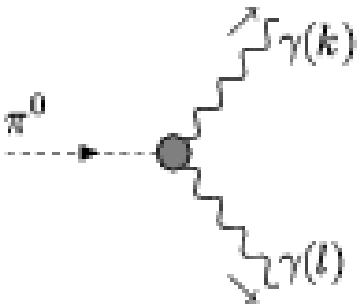
  - $\pi^0 \rightarrow e^+ e^- \gamma$ BR=1.198%
    Independent of the target thickness



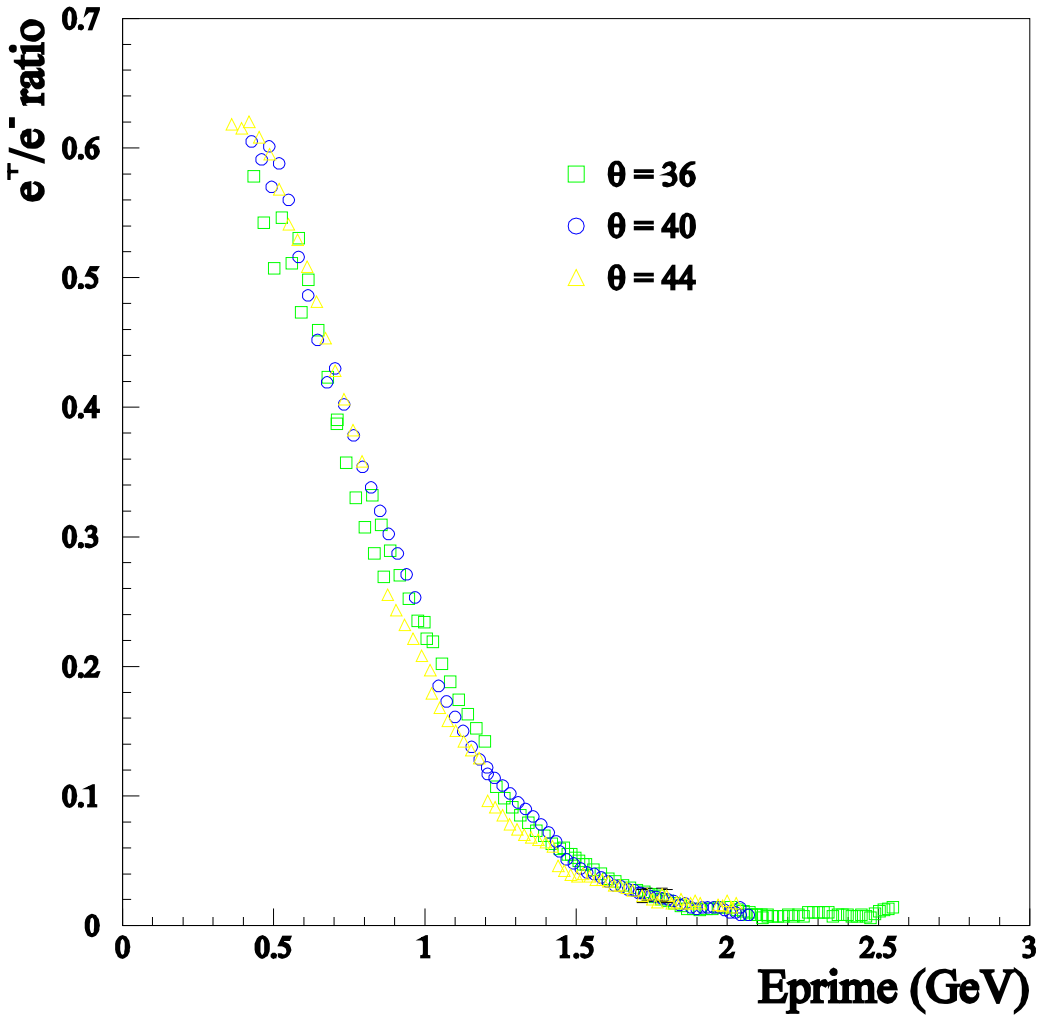
Conversion of

  - $\pi^0 \rightarrow \gamma\ \gamma$ BR= 98.798%

Depends on the amount of material between the vertex and the detector



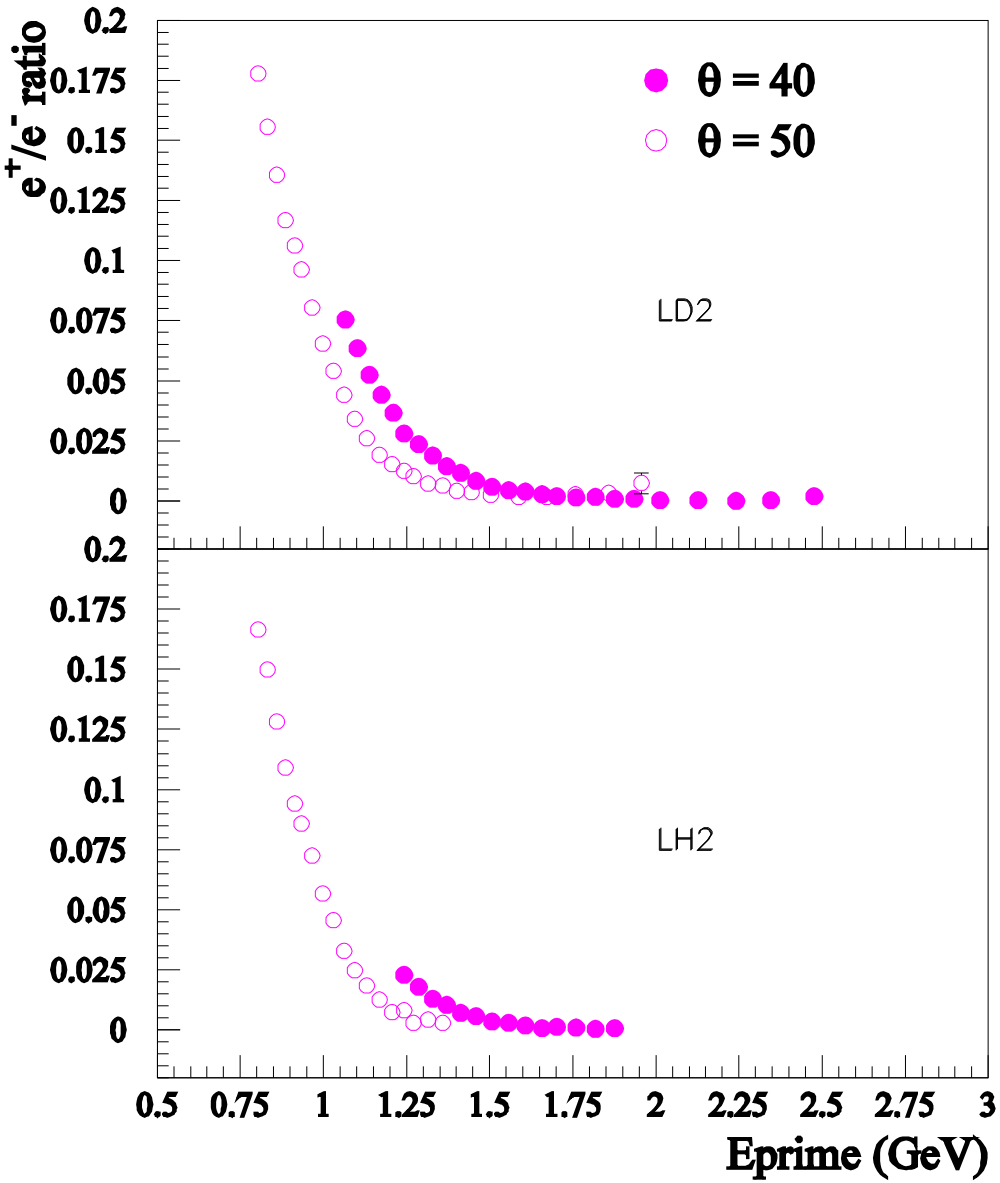
CLAS EG1b DATA



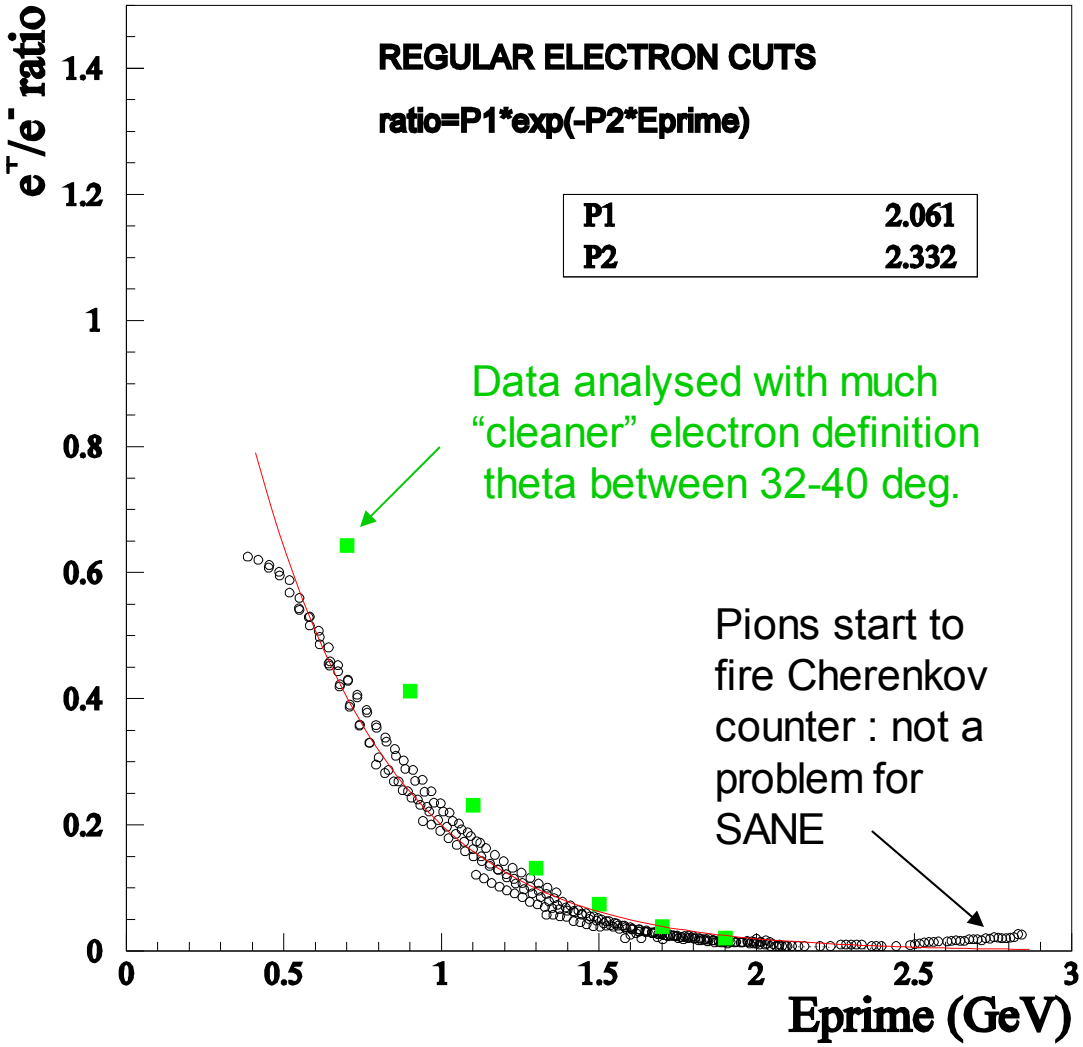
- The e^+ rates for a specific bin with e^- rates for the same kinematic bin but with opposite torus magnet setting
- Ensures identical acceptance
- Data analyzed with standard EG1 electron cuts (not corrected for pion contamination)
- Small theta dependence at low E'

HALL C DATA

- Preliminary Hall C analysis from Jason Seely
- Clear theta dependence
- Contamination is small at large angles



BACKGROUND IN SANE



- A fit to CLAS EG1b data
  theta between 32-48 deg
  → SANE acceptance

- For SANE, following assumptions were made

  - ✓A factor of 1.4 for increase in photon flux

  - ✓A factor of 1.3 for increased amount of material in which photons can pair produce

  - ✓A factor of 2 if charge is not measured

Asymmetry Analysis

The measured electron asymmetry must be corrected for the counts and asymmetry coming from the background

$$A_{raw} = \frac{N^+/Q^+ - N^-/Q^-}{N^+/Q^+ + N^-/Q^-}$$

- $N^{+/-}$ are the counts
- $Q^{+/-}$:Integrated beam charge

❑Physics asymmetry $A_{||}$

$$A_{||} = \frac{C_{back} A_{raw}}{P_b P_t \times DF} + RC$$

- P_b: Beam polarization
- P_t : Target polarization
- DF : Dilution factor
- C_{back} : Background processes
- RC : Radiative correction

Pair symmetric correction +
Pion contamination

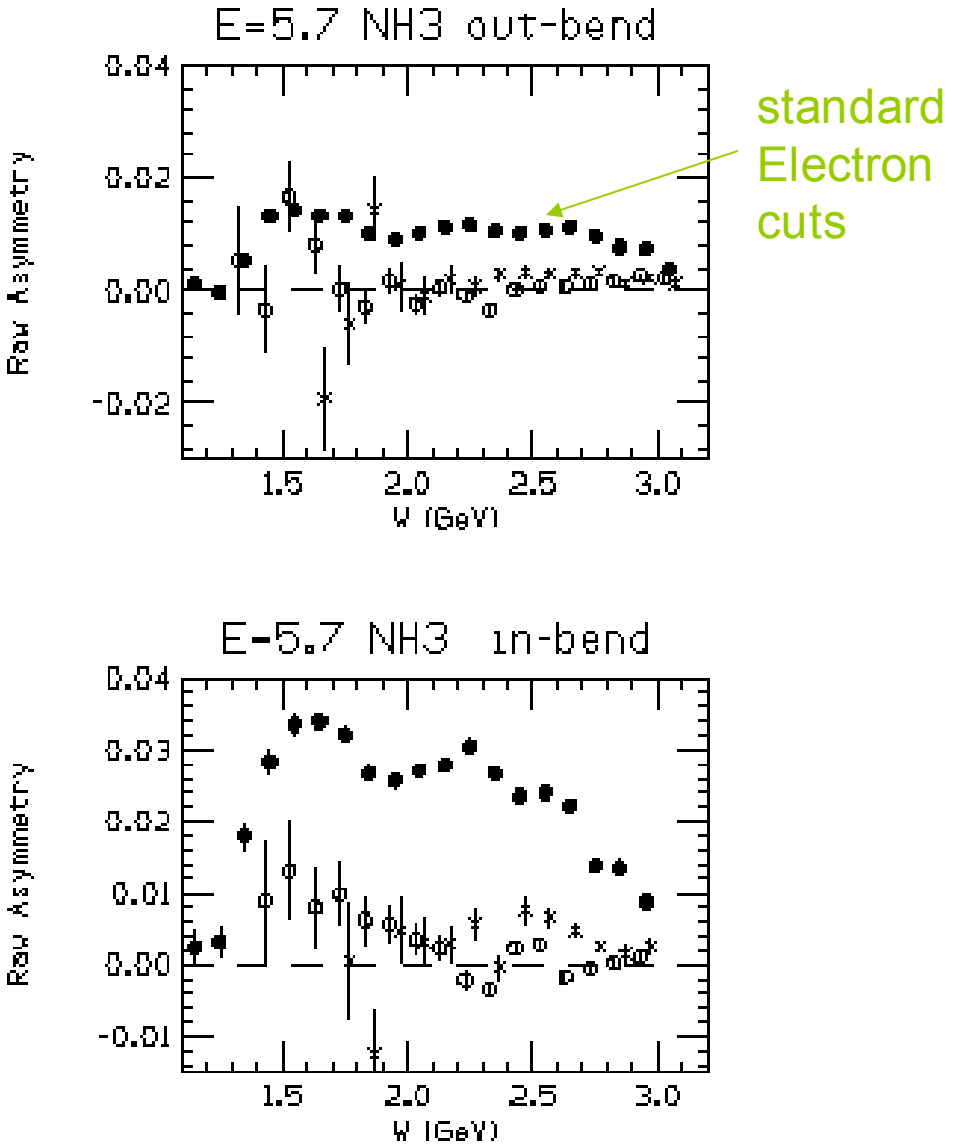
$$C_{back} = \frac{1 - \left(R_{\pi^-/e^-} A_{\pi^-/e^-}\right) - \left(R_{e^+/e^-} A_{e^+/e^-}\right)}{1 - R_{\pi^-/e^-} - R_{e^+/e^-}}$$

ASYMMETRIES DUE TO BACKGROUND

o positive particles

X negative particles

- Averaged over all Q^2
- Asymmetry due to background is nearly zero
- For SANE :
  Measure the π^0 asymmetry
  → Peters talk



Approximate systematic error in background correction

- If we assume $A_{e+/e-} = A_b = 0$, but has an uncertainty given by dA_b/A_e
- f is the e^+/e^- ratio
- Systematic error is given by,

$$A = \frac{A_{raw}}{1 - f}$$

$$\frac{\delta A}{A} = \sqrt{(df)^2 + \left[f\left(dA_b / A_e\right)\right]^2}$$

20%

E' (GeV)	dA/A
0.500	0.843
0.600	0.668
0.700	0.529
0.800	0.419
0.900	0.332
1.000	0.263
1.100	0.208
1.200	0.165
1.300	0.130
1.400	0.103
1.500	0.082
1.600	0.065
1.700	0.051
1.800	0.041
1.900	0.032
2.000	0.026

New hodoscope would help in reducing the error at low E'

For E' < 1.1 GeV error is greater than 20% of the asymmetry

SUMMARY

- The systematic uncertainty due to pair symmetric background is greater than 20% for E' < 1.1 GeV
  E' cut would result in loss of low x data

- New proposed hodoscope would help in reducing this background significantly at least for low E' where it is large

- It is planned to measure the background using HMS. However the acceptance is not the same as BETA

BACKUP SLIDES

CLAS EG1b DATA

- Two methods

Method 1: Cherenkov photoelectron spectrum to determine e+

Method 2 : the energy deposited in the EC

- Numbers agree well