2.5T HRS Asymmetry Comparison

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Background

• Ryan has previously obtained good agreement for 2.2 GeV energy setting for 5T runs, both for transverse and longitudinal orientation

• Good agreement considered to be a $\chi^2$ close to that produced by random fluctuations around one HRS data set

• Attempting to repeat this study for 2.5T Data
Relevant Cuts

• $-0.06 < \theta < 0.06$
• $-0.04 < \phi < 0.04$
• $-0.04 < dp < 0.04$

• Same cuts for both HRS, and for all energy settings
Generated Asymmetries to match Ryan’s existing analysis

$\chi^2$ (right arm theory) = 1.393
$\chi^2$ (right arm random perturbations) = 1.325
$\chi^2$ (left arm theory) = 6.514
$\chi^2$ (left arm random perturbations) = 1.334

$\chi^2$ (Ryan) = $\sim$1.38

2.254 GeV Longitudinal 5 T, 50 MeV Bins
Generated Asymmetries to match Ryan’s existing analysis

2.254 GeV Transverse 5 T, 70 MeV Bins

\[ \chi^2 \text{ (right arm theory)} = 1.699 \]
\[ \chi^2 \text{ (right arm random perturbations)} = 1.345 \]
\[ \chi^2 \text{ (left arm theory)} = 1.690 \]
\[ X^2 \text{ (left arm random perturbations)} = 1.325 \]
\[ \chi^2 \text{ (Ryan)} = \sim 1.65 \]
2.5 T HRS Comparison

2.254 GeV Transverse 2.5 T, 75 MeV Bins

\( \chi^2 \) (right arm theory) = 3.263
\( \chi^2 \) (right arm random perturbations) = 1.345

\( \chi^2 \) (left arm theory) = 1.970
\( \chi^2 \) (left arm random perturbations) = 1.342

- Points around 500 MeV, 1320 MeV, and 1380 MeV seem to show evidence of a systematic shift, currently investigating what this might be
- All other differences are well within error bars
2.5 T HRS Comparison

1.711 GeV Transverse 2.5 T, 75 MeV Bins

\( \chi^2 \) (right arm theory) = 5.714
\( \chi^2 \) (right arm random perturbations) = 1.345
\( \chi^2 \) (left arm theory) = 4.711
\( X^2 \) (left arm random perturbations) = 1.327

- Have not looked into deeply yet but there appear to be large differences at this energy setting on first pass
2.5 T HRS Comparison

1.157 GeV Transverse 2.5 T, 75 MeV Bins

\[ \chi^2 \text{(right arm theory)} = 11743.247 \]

\[ \chi^2 \text{(right arm random perturbations)} = 1.331 \]

\[ \chi^2 \text{(left arm theory)} = 9377.582 \]

\[ \chi^2 \text{(left arm random perturbations)} = 1.329 \]

- Karl has suggested that the tiny error bars seen on this energy setting are likely incorrect, and the reason for the absurd \( \chi^2 \) difference.
- Have not yet determined the reason for this issue.
Details

• In all cases, Ryan has suggested to use the better $\chi^2$ from treating the left arm as theory vs the right arm as theory.
• Bin size has significant effect on $\chi^2$ difference, evidence of systematic effect?
Further Work

• Investigating the systematic shifts in 2.5 T 2.2 GeV energy setting
• Determining source of potential error in 1.1 GeV energy setting asymmetries
• Applying Toby’s dilutions to raw asymmetries – mostly completed, but not relevant to asymmetry comparison