Some thoughts

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Abstract

Considering some experimental practicalities.

1 General Systematics of Asymmetry

The systematic uncertainty of an asymmetry is very much experiment dependent. Table 1 shows some rage in uncertainties seen at JLab. The references are listed in previous note.

It is possible to do high precision measurements of asymmetries such as Q-weak, parity violation where the main source of error is beam polarization. Lots of money and work goes into reducing this error in polarimetry. For us the main source of error will be from target polarization and how this effects the normalization of the components in the asymmetry.

Its is likely that my earlier tensor asymmetry error from last weeks prediction can be grossly under estimated. This estimation uses only moderate uncertainties bases on standard vector polarization techniques. The uncertainty based on positive tensor polarization is expected to be 10-15%. The uncertainty for negative tensor polarization can be considerably larger. We have no real data to estimate this. It would be difficult to make an argument that we expect anywhere near as small as Hermes systematic uncertainty.

(#)	source	error (%)	min. δA_{sis}
(1)	Target Polarization	3-7%	5×10^{-3}-5×10^{-4}
(2)	Beam Polarization	1-3%	1×10^{-4}-1×10^{-6}
(3)	Time Variations in L	1-0.5%	1×10^{-5}-1×10^{-6}
(4)	Detector Resolution	0.2%	1×10^{-6}-1×10^{-7}

Table 1: The systematic error estimates of general asymmetries at Jlab. Contribution listed in leading order.

2 Ansatz for A_{zz}

Here is a quick discussion in the investigation of how to get from the canonical form of the observable A_{zz} to something that can be measured. Lets assume that the Hermes negative N^0 and positive N^1 states in the tensor polarization are consistent with what can be achieved by flipping the polarization of the solid target. To stay consistent with notation and interpretations consider the asymmetry,

$$A_{zz} = 2\frac{N^+ - N^-}{|P_{zz}^+|N^- + |P_{zz}^-|N^+}, \tag{1}$$

where the number of events comes from direct observation from positive (negative) target polarization N^+ (N^-) defined by,

$$N^+ = \sigma^u L(1 + \frac{1}{2}|P_{zz}^+|A_{zz}) \tag{2}$$

$$N^- = \sigma^u L(1 - \frac{1}{2}|P_{zz}^-|A_{zz}) \tag{3}$$

$$A_{zz} = 2\frac{N^+ - N^-}{|P_{zz}^+|N^- + |P_{zz}^-|N^+} = 2\frac{1 + \frac{1}{2}|P_{zz}^+|A_{zz} - 1 + \frac{1}{2}|P_{zz}^-|A_{zz}}{P_{zz}^+ + P_{zz}^-} = A_{zz}. \tag{4}$$

Here again I am trying to be optimistic in the hopes that the state $m = 0$ difference is isolated in the numerator such that the density of state $m = \pm 1$ is known in either case of the vector polarization. We know that the separation from T_{11} and T_{2m} depend on P_{zz}, θ, and ϕ. There are additional concerns in regards to tensor polarization calculation in correlation to state density and separation of vector and tensor scattered events.

For the purpose of rates lets consider what the statistical error should look like use standard error propagation to get,

$$\delta A_{zz} = 2(|P_{zz}^+| + |P_{zz}^-|)\frac{\sqrt{(N^-\delta N^+)^2 + (N^+\delta N^-)^2}}{(|P_{zz}^+|N^- + |P_{zz}^-|N^+)^2} \sim \frac{\sqrt{2}}{P_{zz}\sqrt{N}}. \tag{5}$$