SIDIS with Polarized Target

Asymmetry and/or $\delta\sigma$

- Asymmetry: $A = \frac{1}{P_T P_B f} \frac{\delta N}{N}$
- where f is dilution factor
- $\delta\sigma = \frac{1}{P_T P_B A t C} \delta N$
- where A is acceptance
- t is target thickness
- C is integrated beam charge
- Rad. corr. and beam, target polarization common problems to both analyses.

Asymmetry advantages

- Don't need to know acceptance
- Time-variations in detector efficiency mostly cancel out with double cell design

Asymmetry drawback

- need to know target composition (grams of p, He, N, Al)
- This requires some running with unpolarized targets of known thickness (carbon foils, pure helium), etc. Could think of carbon foils which can be flipped in/out of beam line, but most likely will require dedicated running time, with significant overhead. Running conditions won't be identical, and it will be cumbersome to do frequently.
- Need to know ratio of radiated xsections from p to He, N, and Al versus (x, Q^2, z, p_t, ϕ^*), for each of π^+, π^0, π^-. This would best be done with dedicated run time with special target ladder with at least hydrogen, carbon, and aluminum. Even, have to account for difference in radiation lengths of targets, and difference in z positions.
- Some information will come from Hall C, but only for π^+ and π^-, and only for proton and deuteron, and limited coverage at high p_t

$\delta\sigma$ Advantages

- To first order, don't need to know anything about nuclei (how much, cross section)

$\delta\sigma$ Drawbacks

- Need to know integrated beam charge.
- Need to know gm/cm^2 of free protons
- need to know electron acceptance and detection efficiency
- Need to know pion (π^+, π^0, π^-) acceptance and detection efficiency.
- Less events because the above generally result in fairly tight fiducial cuts and lower beam current for higher and more stable drift chamber efficiency.

$\delta\sigma$ Calibration

- Can we use $\delta\sigma$ from e-p elastic to get luminosity and efficiency for electrons (in narrow (P, θ) band).
- Can we use $\delta\sigma$ in e p inclusive to extend this to larger (P, θ) region (assuming g_1 is already known!)
- Can we various exclusive reactions to determine hadron effective acceptance and efficiency? Does this require some running with pure hydrogen?
- A lot of careful thought needs to go into auxiliary targets, run plan, and analysis strategies.