Experimental Systematics

Tasks Needed to investigate

Dilution factor using MC to calculate using assumed cross sections (Also make run plan to reproduce MC effort (single or dimuon))

Also

need to know:

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What is the statistical reduction by reducing target size (error bar projection)

What is the statistical reduction by reducing beam intensity to magnet maximum (error bar projection)

Systematics due to polarized target, microwave, dynamic dilution factor,
Beam Heating Polarization Effects, Uneven decays in Polarization
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List of contributing systematics

$A_{measure} = fPA_{physics}$

dilution factor $f = {}_{\text{polarized Nucleon}} /_{\text{Nonpolarized Nucleon}}$

In order to explore the physics of interest we must try to mitigate know errors and measure what uncertainties we can.

Should try to stay below over all systematic contribution of what limit in the asymmetry?

Detector Contributions:

Acceptance: Look at previous data using SeaQuest and check for false asymmetries also use Monte Carlo to study phi-modulation

MC study needed for detector acceptance corrections

Fiducial Limits: Study detector limitations and necessary cuts

Time Variations: Look at time dependence from gas or field drifts

Accidentals: Study contribution of pion-decay accidental background to the left-right asymmetry

Tracking and Reconstruction Error: Compare background seen in MC and real data

Trigger Inefficiency: Understand efficiency in trigger and expected limitations and asymmetries associated

Change in instrumental noise: Prop tube, chambers, etc...

Event Selection:

PID, IM Cuts

target events:-250<Z<50cm

Beam dump events: -50<Z<200cm

Tracking Quality Cuts

Beamline Uncertainty:

Luminosity: Variation in luminosity not accounted for

Beam Drifts: Drifts over beam spill or over several hours leading to false left-right asymmetry

Scrapping: Left-right asymmetries induced by beam scrapping

Dead-time: Need accurate accounting for dead-time and efficient monitoring of detectors in this accounting

Some general issues: Large beam x-y profile, narrow target size, beam position drifts (dx~1-2mm), non-uniform DC response to large beam intensity fluctuations

MC study needed to correct target/beam dump acceptance difference

MC Trigger road bias and efficiency studies

Systematic flips: Fmag, kMag, polarization check inpact of relative beam on target beam luminosity

Maybe use events from beam dump to normalized the detector acceptance effects

Target Systematics: (Can be different for proton and deuteron)

Know Uncertainty in polarized target: TE, Temp/pressure measurements, baseline, mag field drifts, charge averaging, NMR tune drifts, area measurements see Errors in Polarized Targets

Dilution Factor: Must be measured and calculated

Packing Fraction: Must be measured and calculated

Initial Polarization Homogeneity: Microwave induced differences

Beam Heating Polarization Effects: Secondaries scattering off the down stream end might heat things up to lower the polarization

Uneven decays in Polarization: The target receives a different dose over its length