Issues and Considerations for SIDIS

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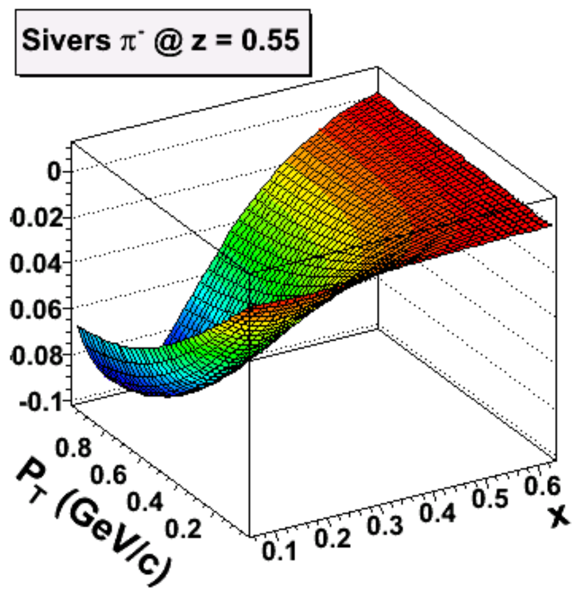
SoLID-Spin: SIDIS on ^{3}He/Proton @ 11 GeV

E12-10-006: Single Spin Asymmetry on Transverse ^{3}He @ 90 days, **rating A**

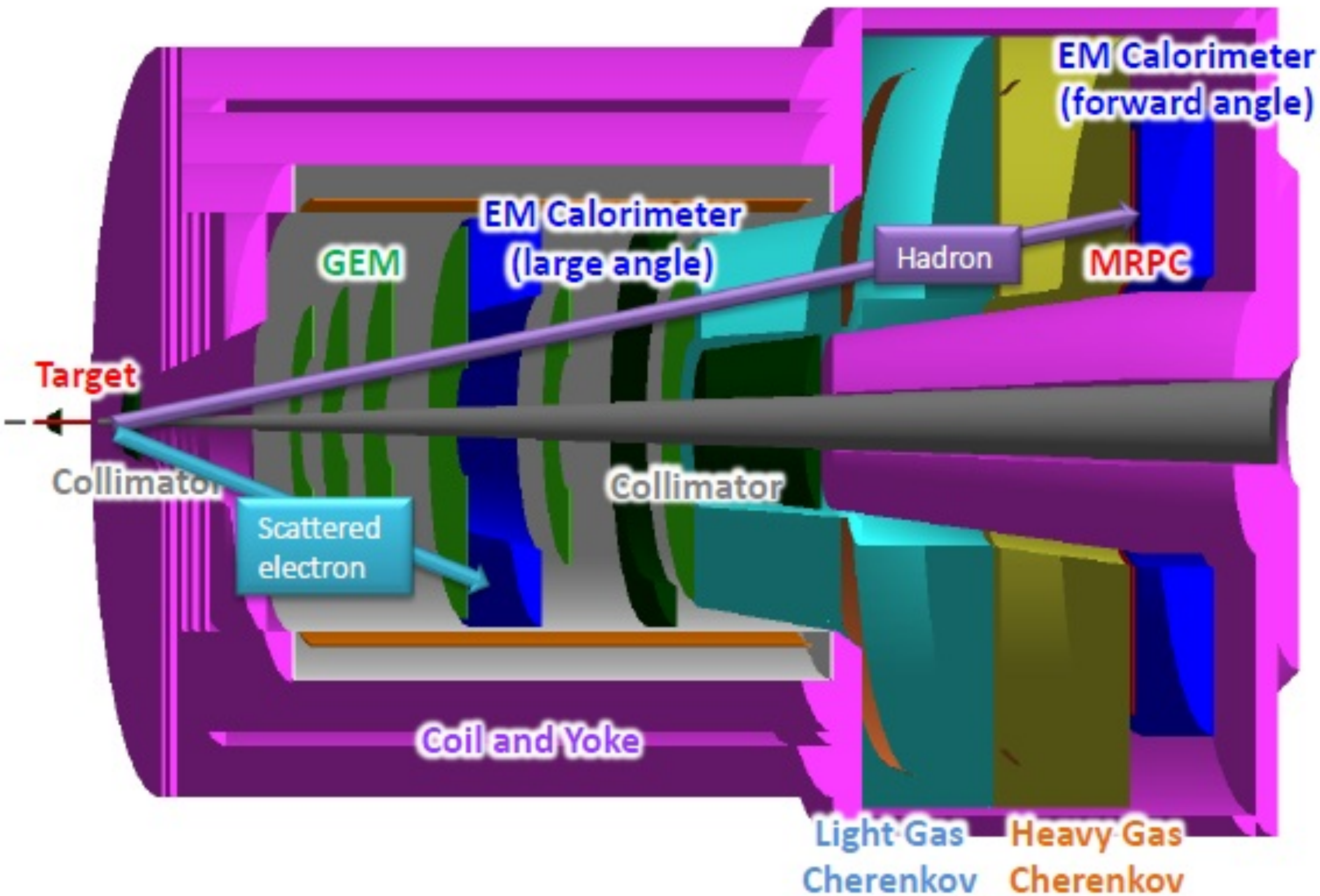
E12-11-007: Single and Double Spin Asymmetry on ^{3}He @ 35 days, **rating A**

E12-11-108: Single and Double Spin Asymmetries on Transverse Proton @120 days, **rating A**



Key of SoLID-Spin program:
Large Acceptance
+ High Luminosity
→ **4-D** mapping of asymmetries
→ Tensor charge, TMDs …
→Lattice QCD, QCD Dynamics, Models.

SoLID CLEO SIDIS



Requirement of SIDIS

- Kinematics Coverage:
  - **0.05 - 0.6 in x (valence)**
  - **0.3 - 0.7 in z (factorization region)**
  - **P_T up to ~ 1 GeV (TMD Physics)**
  - **Fixed target → Q^2 coverage 1-8 GeV^2 (~ 2 GeV^2 in ΔQ^2 at fixed x)**
- Luminoisity:
  - **Unpolarized ~ 10^{37} $N/cm^2/s$**
- Polarized ^3He Target:
  - **~ 60% higher polarization**
  - **Fast spin flip (<20 mins)**
- Electron PID:
  - **<1% Pion contamination (asymmetry point of view)**
- Pion PID:
  - **<1% Kaons and Protons**
  - **<1% electron contamination**

Modified from X. Qian's slide

- Optics of Reconstruction:
  - **< a few % in $\delta P/P$.**
  - **< 1 mr in polar angle.**
  - **< 10 mr in azimuthal angle**
  - **~ 1-2 cm vertex resolution**
- Polarized NH_3 target
  - JLab/Uva target with upgraded design of the magnet
  - Target spin-flip every two hours average in-beam polarization of 70%
  - Polarized luminosity with 100nA current: 10^{35} $cm^{-2}s^{-1}$
  - Beamline chicane to transport beam through 5T target magnetic field (g2p one?)
- DAQ:
  - **~ 3kHz Physics Coincidence**
  - ~ 200 kHz Single electron
  - ~ 50 kHz Coincidence
  - **Limits: 300 MB/s to tape.**

Special Considerations

- Uniformity:
  - E.g. Design of Detector Support Structure to minimize holes in acceptance (especially in azimuthal angle)
- Backgrounds in Detectors
- Radiation:
  - Design of Detector front end electronics and calorimeter
    - Minimize radiation damage
    - Maximize radiation hardness of design.
- Multiple New Detectors:
  - Need dedicated time to commission detectors and system integration.
  - Multiple/Staged beam tests needed for detector R&D.
  - Detailed Integration Plan.

- Mechanical Design:
  - Compact
  - Detector maintenance
  - Cable layout
  - Switch between different configurations:
    - Transverse vs. Longitudinal
    - SIDIS vs. PVDIS
  - Alignment
- Procedure of quick establishment of detector performance:
  - Position of Tracking detectors
  - Energy response in Calorimeter
  - Background/Gain in Gas Cerenkov
  - Physics asymmetry in single hadron, and zero PV will help in this.

Potential Issues

- Hadron pid (simulations ongoing)
- Pid detectors in open geometry (more realistic simulations)
- trigger signal splitting issue (ongoing study for PVDIS)
- Will single trigger work? (both coincidence and single triggers discussed)
- Large angle detectors (optimization)
- Sheet of flame (NH_3)
  - GEM and gas Cherenkov OK from preliminary studies, more studies
  - Studies for calorimeter and impact on trigger needed
- Photon suppression (scintillator plane before preshower)
- Tracking
  - Progressive tracking
  - Tree search
- GEM resolutions