ITAC Report June 5, 2024

J-24-RunGroupH:

CLAS12 Run-Group H Experiments with a Transversely Polarized Target

The choice to move from the HD-Ice polarized target to an NH3 polarized target is a significant change to the original proposal that completely changes the entire technical scope of the proposal. Similar to the hypernuclear experiments proposed for Hall A but then moved to Hall C, these significant changes require a new proposal to address all the technical aspects of the experiment that were either different or not present in the original proposal. Neither the required 5T transverse magnet nor the required magnet chicane system exist and all need to be designed and built. In particular, the design of the transverse target magnet will impact the possible acceptance and design of the recoil detector.

Comments:

1. The original proposals with HD-Ice targets (*e.g.* C12-12-009) assumed a target polarization of 60% and a luminosity of 5*10^33. These assumptions lead to a figure-of-merit ratio of NH3/HD=0.56 and not 2.4 as quoted in this report.
2. The geometry of the recoil detector is not defined nor are its requirements in terms of acceptance in physical space and momentum space.
3. What are the expected modes of operations for the target magnet and chicane magnets? Are these magnets expected to be operational all the time during beam operation to reach the beam dump or are there modes of operation envisioned where the magnets are off and a straight beamline is required?
4. Beam tuning may be difficult because any beam loss into the superconducting magnets cooled by pulse tube refrigeration will cause a quench and the recovery time will be of order 24 hr. A dedicated beam loss detection system and beam dump system may be needed.
5. The transversely polarized target has been developed through a conceptual design phase, but a detailed design still must be developed and fully costed. Considerations of R&D and system testing must be developed and a realistic cost and schedule prepared.
    a. A decision must be made on the target magnet orientation to advance background and shielding studies.
    b. Shielding of local electronics and control systems from expected background rates about the Space Frame needs to be considered for different target magnet field directions.
6. Commercial magnets for the beam chicane system are being considered. Work with the Hall B engineer must be advanced to lay out the planned RG-H beamline, including power and utilities.
7. The beam raster system is not discussed in the jeopardy document. Has its effects on beam transport and beam-related backgrounds been considered in detail?
8. Does the target system have adequate cooling due to beam heating effects from synchrotron radiation generated in beam transport?

9. With an advanced design of the beamline and target, detailed background simulations need to be advanced to understand luminosity limitations in the drift chambers and recoil detectors.
10. The leptons subject to deceleration in the target by emitting synchrotron radiation will be bent in the “horizontal” plane away from the nominal beamline and entering sector 4 of the CLAS12 spectrometer. Sectors 1 and 4 are equipped with PID Cherenkov detectors and such high radiation from these electrons (“sheet of flame”) may be detrimental to them.