**Proposal:** C12-24-RGH

**Hall:** B – CLAS12

**Title:** CLAS12 Run-group H Experiments with a Transversely Polarized Target

**Contact:** M. Contalbrigo

**Beam time request:** 125 days

**Tune up time and target changes:** 25 days commissioning, calibration and target operations

**Configuration changes included:** target material changes requiring beamline removal, twice

**Electron beam energy:** 11 GeV

**Electron beam current / luminosity:** 1 nA / 5x1033 cm-2 s-1

**Electron beam polarization:** High (85%)

**Targets:** Transversely polarized NH3 target

**Basic instrumentation:** CLAS12 Solenoid moved upstream; no Central Detector; one RICH sector swapped; no DC in Sector

**Non-standard instrumentation?** New transversely polarized NH3 target inside a 5-T split-coil magnet with a vertical field orientation, new beam chicane using 3 superconducting 7.5 T split-pair magnets, new recoil detector consisting of a tracker and a time-of-flight detector

This proposal has been reviewed and approved by the CLAS Collaboration.

Summary: C12-12-009 will study the semi-inclusive reaction ep → e h1 h2 X (with h1 and h2

two identified final-state hadrons) to access the transversity distribution and its first

moment, the tensor charge, in a reaction that provides a benchmark for the alternative TMD extraction.

C12-11-111 will study the semi-inclusive reaction ep → e h X, (with h an identified

hadron), to access leading-twist parton distribution functions in a transversely polarized nucleon.

C12-12-010 will measure DVCS on the proton, ep → e p γ, whose azimuthal spin asymmetries depend on combinations of GPDs, to provide access to the GPD E.

# Technical Comments:

Requires the design and construction of a new target system, including transverse, split-pair 5-T magnet. Estimate 2 – 3 years Target Group effort.

Compared to Run Group C, lower beam current: estimate six days before annealing is needed (14 with two materials on ladder). In situ annealing with heaters. 70 – 80 days before NH3 material replacement is needed.

Limited overhead space: cryostat will be retracted for material changes, requiring beamline disassembly. Planned twice.

No major technical hurdles are foreseen in the polarized target design or construction, as it is essentially a scaled-down copy of the existing system previously utilized in Halls A and C. Location of pumps, electronics, and insertion cart not specified.

Jefferson Lab Technical Note TN-24-017 discusses the commercial magnet assumed, see <https://jlabdoc.jlab.org/docushare/dsweb/View/Collection-58452> . The magnet spacing in Figure 25 is not symmetric so different fields will be required for each of the magnets. Spacings are 130”, 139” and 136”. If the first two gaps were equal it would be a lot easier to tune the line.

Does the chicane tolerate different beam energies between 10.4 and 11.0 GeV?

Recently it has been shown that stripline BPMs with digital receivers do as well as the nA cavity BPMs as long as the current is greater than 25 nA. Placing such between each pair of magnets would help set up the line. These would be part of the Physics Division costs incurred to mount the experiment. The cavity BPM will have to be rotated so its axis coincides with the beam in the last leg of the chicane, as appears to be the case in the bottom of figure 25. Will the vibrations from the pulse tube refrigerators cooling the three chicane magnets have any effect on the detectors?

No allowance for packing fraction in the systematics unless that is covered as dilution. If so, 2% seems low. Nor is there any allowance for beam polarization error. The Hall B Moller spectrometer is a +-1.5% instrument at best. Comparing to A and C measurements I'd use +-2%.