**Proposal Number:** PR12-15-005 **Hall: C**

**Title:** Measurements of the Quasi-Elastic and Elastic Deuteron Tensor Asymmetries

**Contact person:** Elena Long

**Beam time request:**

Days requested for approval: 44.3 days

Tune up included in beam time request: No

**Beam characteristics:**

Energy: 8.8, 6.6, 2.2 GeV

Current: 80 nA

Polarization: No

**Targets:**

Nuclei: UVa/JLab Polarized ND3  
Carbon

Target Cryo Load: < 100 watt

Rastering: Yes (Slow raster)

Polarized: Yes

**Spectrometers:**

HMS Yes

SHMS Yes

Other (BigCal, etc.): No

**Special requirements/requests:**

* Installation of the UVa/JLab Polarized ND3 target.
* Possible custom BCM/BPM hardware for thermal stabilization, long period baseline tracking, and low-noise, linear readout at < 100 nA beam currents.
* Possible SHMS HB/Q1 magnetic fringe field shielding.

**Technical Comments:**

1. Significant laboratory engineering and technical resources will be required for the JLab Hall B/UVA polarized ND3 target (A.K.A. he “g2p longitudinally Polararized Target”)
2. As with C12-13-011 (“b1”), this experiment relies on the tensor polarization of the ND3 target. C12-13-11 was conditionally approved (C1) in PAC40, and dependent on demonstrating “that a tensor polarization of at least 30% be achieved and reliably demonstrated under experimental conditions.” [from PAC40 Final Report, p 19]
   1. The “RF hole burning” technique used to enhance the tensor polarization removes the ability to extract the tensor polarization value from the more easily measured vector polarization. Techniques to address this issue are only at the R&D stage at this time.
   2. As it is not clear how to measure the target tensor polarization obtained through “RF hole burning,” it is proposed to calibrate the target polarization using known values of T20 at low Q2. As the target must be depolarized and repolarized many times throughout the experiment, can this calibrated polarzation be relied upon to be stable as high Q2 measurements are made?
3. Fringe fields from the upstream SHMS magnets (particularly the HB) may couple significantly to the target magnet and vice versa. This coupling should be investigated with an eye on stability and crosstalk during quench events, etc. (For example, if the HB quenches, will the collapsing field couple to the target and take it down too?)
4. The proposal text states one of the dominant systematics is target field stability (p35). The field coupling between the SHMS HB and the target field noted above may also impact the net holding field at the target as a function of both the SHMS momentum (field) setting, and spectrometer angle. The proposal comments on knowing the holding field to dB/B at the 100 ppm level.
   1. Adding magnetic shielding to isolate these fields is a non-trivial undertaking and may be difficult with the SHMS at small angles.
5. Will the effective target density change between polarized/unpolarized runs due to ND3 bead displacement/resettling during the LHe boil-off/refill procedure used to kill the polarization? The text suggests this may result in a 10-3 change in eff. target length, but that such rearrangements would be immediately noticed as a change in the NMR signal. If such a disturbance is noted, can one then correct for it, or are the prior data unusable?
6. Tracking BCM and BPM drifts at < 100 nA beam currents over the long periods used for the polarized and unpolarized runs will be challenging. The proposal suggests adding temperature monitoring and recirculating heat regulation systems to the BCM pillbox and analog cabling.
   1. Implementation and verification of such systems will require significant lead time and human resources.
   2. It should be noted that 75 nA is the nominal “lower limit” of the existing readout systems in Hall C. New high gain electronics will be needed to reliably measure at lower beam currents.