PR12-13-010: reply to TAC report

June 17, 2013

Comment 1: *Significant hall engineering resources will be required.*

We agree, and if this proposal is approved we would welcome an early technical review to identify those resources.

Comment 2: *Removal of SHMS Horizontal Bender is necessary for installation of sweeping magnet for* γ/π^0 *detector. Reinstallation should be fairly straightforward with minimal impact on SHMS optics.*

We agree.

Comment 3: *The* γ/π^0 *detector will be positioned at distances of 3, 4, and 6 m from the target. The ability to quickly (and reproducibly) move the detector will need to be carefully considered in the design of the detector support system.*

We will consider this carefully in the design.

Comment 4: *Given the (potential) amount of data generated by the* > 1000 *blocks of the NPS, additional hall resources for online data processing and storage may be required. As a benchmark, the Q-weak experiment took data at a rate on the order of 10 Mb/s this put significant strain on hall computing resources.*

Reading 26 samples of the FADC modules (104 ns sampling window) implies an event size of 64 bytes per channel. We expect cluster size to be around 25 blocks and we do not expect an average of more than 3 clusters per event, that is 75 blocks. With these assumptions and the integrated DIS cross section in the HMS acceptance, in most of the kinematics we can read every single HMS trigger with a data throughput of less than 20MB/s, which we have successfully done in the past in Hall A. Two particular kinematics with high DIS cross section will require a coincidence trigger with the $PbWO_4$ calorimeter in order to reduce the data acquisition rate below this limit.

Comment 5: *If the proposal is approved, then a review of the experiment should be scheduled early to address technical issues and identify the source of (users vs. lab) of various resources.*

As in comment 1, we will welcome a technical review if the proposal is approved.

Comment 6: *The HMS will be near (and in one case exceed) its designed limit of 7.3 GeV/c where it has not been run before. Having a short test run of the HMS* *near 7.3 GeV/c to study the optics and acceptance prior to the experiment would be beneficial.*

We will appreciate the opportunity to test the HMS optics and acceptance near its momentum limit. Notice, however, that the HMS momentum bite (10%) is sufficiently large that setting its central momentum at 7.1 or 7.2 GeV/c will allow us to collect sufficient data in the kinematics proposed.

Comment 7: *Time requested in this proposal is run time on LH2 only. No time is requested for tune-up, spectrometer checkout, BCM calibrations, polarimetry, or aluminum dummy running for cryotarget cell wall subtraction.*

We have chosen not to include set-up and detector check-out in the proposal beamtime request as this depends on scheduling. Notice that this beamtime overlaps with PR12-13-007 and all detector checkout will be common. If the proposal is approved, a discussion regarding this point should be addressed with JLab management.

Comment 8: *Required precision on beam polarimetry is not indicated.*

A systematic uncertainty of around 2% will be acceptable for this experiment. This is the size of the rest of our systematic errors and is compatible with what can be achieved by Hall C polarimeters.

Comment 9: *This experiment will measure energy-dependent cross sections at fixed (x,Q^2). As noted in the proposal, point-to-point uncertainties (Table II) will dominate in any L/T-like separation. However, in some cases, data from this experiment and E12-06-114 (Hall A) will be combined to perform the separation. In that situation, the point-to-point errors in Table II are not directly applicable certain uncertainties labeled scale in that Table will also contribute to the $1/\epsilon$ amplification. It is not clear from the proposal if this has been incorporated in the projections.*

We agree with the general comment. To study this, we have included in our beamtime request 3 cross-check settings, where the same kinematic points will be measured in Hall A and C. By carefully matching the acceptance between the two datasets, we will be able to quantify this uncertainty. We expect this uncertainty to be not larger than 2%, which is the approximate uncertainty in the acceptance of both Hall A and Hall C spectrometers. We agree, however, that the L/T separation coming from combined Hall A and Hall C settings will suffer from a slightly larger uncertainty.

Comment 10: *As written, it is difficult to ascertain which particular settings will be measured in Hall A only vs. Hall C only. Even after examining both proposals, I am at a loss to find the low energy point at x=0.36, Q2=5.5 GeV2. A more comprehensive table including the nominal Hall A only kinematics would be helpful.*

Notice that the energy separation is not proposed for all kinematic settings. Some of our settings are proposed as a kinematic extension (high Q^2 in particular) of what can be achieved in Hall A. These settings do not have a low energy counterpart. Table 1 shows the "Hall A only" kinematics. During the PAC presentation we will try to make clear the physics goals of each of our kinematic sets.

Q^2 (GeV^2)	k (GeV)	x_B	$\sigma(M_X^2)$ (GeV^2)	$\mathcal{L}/10^{38}$ (cm^{-2}/s)	HRS (Hz)	DVCS (Hz)	Time (days)
3.0	6.6	0.36	0.23	0.75	479	1.16	3
4.0	8.8	0.36	0.26	1.3	842	1.74	2
4.55	11.0	0.36	0.27	2	2460	4.63	1
3.1	6.6	0.5	0.17	0.75	873	0.77	5
4.8	8.8	0.5	0.20	1.3	716	0.82	4
6.3	11.0	0.5	0.20	2.	778	0.99	4
7.2	11.0	0.5	0.25	2.	331	0.53	7
5.1	8.8	0.6	0.16	0.75	338	0.27	13
6.0	8.8	0.6	0.18	1.3	227	0.22	16
7.7	11.0	0.6	0.20	2.	274	0.28	13
9.0	11.0	0.6	0.22	3.	117	0.17	20

Table 1: Hall A kinematics for approved experiment E12-06-114

Comment 11: *Running currents for this experiment appear to be chosen based on the luminosity of the previous Hall A DVCS experiments ($10^{37}/cm^2/s$) which ran for 500 hours (21 days) and observed acceptable levels of radiation damage to their PbF_2 calorimeter. Since the integrated dose in the Hall C experiment will be reduced by the sweeping magnet by at least a factor of 5, the currents seem to be conservatively chosen. However, the total estimated dose for the experiment is not tabulated in the proposal, so it is not clear how many times UV curing will be needed during the experiment. An in-situ curing process should be integrated into the NPS design.*

We have estimated counting rates in the calorimeter using P. Degtiarenko's Monte-Carlo simulation, and the integrated dose to the calorimeter calculated as a function of the angle and time of each setting. Total anticipated dose to crystals at the center of calorimeter is 1.7 MRad. Crystals closest to the beam will receive an estimate dose of 3.4 MRad. LHC studies of $PbWO_4$ (RY Zhu NIM A413 p 297, 1998) show only a few percent decrease in light output up to 10 MRad.

Comment 12: *There are no estimates of singles rates or random coincidences in the proposal.*

We list in Table 2 the expected HMS rates (based on the DIS cross section) and the calorimeter single rates for a threshold of 300 MeV and 1 GeV. Coincidence rates in a cluster size of 25 blocks are also shown for each kinematic setting, assuming a 50 ns coincidence window. This coincidence rate represents the number of accidental events per HMS trigger.

E_b (GeV)	Q^2 (GeV^2)	x_B	HMS (kHz)	$PbWO_4$ (MHz) E_{th} =300 MeV	$PbWO_4$(MHz) E_{th} =1 GeV	Random coinc. E_{th} =1 GeV
6.6	3	0.36	0.73	115	27	0.03
8.8	3	0.36	4.40	68	11	0.01
11	3	0.36	13.0	52	7	0.008
8.8	4	0.36	1.20	145	41	0.05
11	4	0.36	2.90	100	22	0.02
8.8	3.4	0.50	3.30	26	2	0.002
11	3.4	0.50	9.00	20	1.3	0.001
11	4.8	0.50	1.70	48	6	0.007
6.6	5.1	0.60	0.053	79	14	0.01
8.8	5.1	0.60	0.34	39	4.2	0.005
11	5.1	0.60	1.10	27	2.2	0.002
11	6	0.60	0.45	43	5	0.006
6.6	2	0.20	0.26	30	14	0.02
8.8	2	0.20	1.30	18	6	0.007
11	2	0.20	47.0	28	8	0.009
11	3	0.20	0.70	30	14	0.02
11	5.5	0.36	0.53	222	86	0.1
11	8.1	0.50	0.072	220	84	0.09
11	10	0.60	0.017	220	85	0.1

Table 2: Single rates in HMS and $PbWO_4$ calorimeter for each kinematic setting. Random rates in calorimeter are calculated assuming a coincidence window of 50 ns and a solid angle of 25 blocks.