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Report of the

Jefferson Laboratory
Program Advisory Committee

PAC 28

Meeting of August 23-26, 2005

Letter from the Director

September 1, 2005

Members of the Jefferson Lab User Group,

A great deal has happened to position Jefferson Lab and its unique scientific programs for the future since the last PAC meeting, the most notable of which is the DOE Independent Project Review of the 12 GeV Upgrade Project in July. The Review had no findings and stated that the project was ready for CD-1approval, the next milestone. This is a very important step for the project team and for Jefferson Lab's users who have been working toward the 12 Gev Upgrade for many years.

This Program Advisory Committee reviewed 15 proposals and 3 letters of intent. Of these, 7 were approved, 2 were conditionally approved, 3 were deferred with regret, and 3 were deferred. The PAC continues its tradition of high standards for approved beam time and does its part to ensure that Jefferson Lab remains focused on doing the very best science. Peer review, such as that done by the PAC, is critically important in establishing a research program of forefront, compelling science. I want to commend the 28th PAC particularly for their "activist" engagement and useful voice on how to maximize scientific return within our constrained circumstances.

Serving on the PAC is both an honor and a responsibility, and we are fortunate that we have four new members, Barbara Badelek, Naomi Makins, David Bowman and Gordon Cates, to replace those PAC members who have completed their terms and are rotating off. I want to thank Nicola Bianchi, T. William Donnelly, Eddy Jans, and Peter Kroll for their work and dedication as part of the PAC and wish them continued success in their research.

Sincerely,

Christoph W. Leemann
Director, Jefferson Lab

Letter from the PAC Chairman

Introduction

The Jefferson Laboratory Program Advisory Committee held its 28th meeting on August 23 - 26, 2005. The membership of the Committee is given in Appendix A. In response to the charge (Appendix B) from the JLab Director, Dr. Christoph Leemann, the Committee reviewed and made recommendations concerning the fifteen proposals and three letters of intent submitted by JLab users.

General Overview

The meeting was stimulating in terms of the discussions of new physics results which emerged from recent JLab measurements and the plans for new measurements proposed for the physics research program. Impressive new data were presented from all Halls. In Hall A, due to an appreciable improvement of the overall energy resolution, hypernuclei are produced, that will allow us to gain important information on the nuclear spin-orbit and spin-spin part of the Λ-N interaction. In Hall B two high statistics experiments yield no signals of pentaquarks in production channels in which signals were observed previously at JLab and abroad. It is remarkable that these experiments have been carried out, including data analysis, within 18 months after their approval by the PAC. The management demonstrated a high degree of flexibility in the process of the beam time scheduling. Studies of the transition form factor of the Roper resonance provide precise data that discriminate between various model calculations of the nucleon. By measuring the x_B-dependence up to x_B = 2.8 for ^{4}He, ^{12}C and ^{56}Fe, remarkable signals have been observed providing the first ever hints for three-nucleon short-range correlations in inclusive experiments. In Hall C the results of the G0 forward angle measurements were presented. They, certainly, provide interesting information in the quest to determine the strange quark contribution to the proton form factor.

The PAC is also very pleased to see the progress made by the Lab toward the JLab 12 GeV-upgrade. CD-0 has been reached in March 2004 and all CD-1 prerequisites were met with formal CD-1 expected in fall 2005.

The overall JLab program continues to show solid growth; prior to PAC 28 it included 155 approved experiments. To date, 113 experiments have been completed at JLab, up by 3 over the last six months. 31 papers have been published or submitted to the Physical Review, Physical Review Letters and Physics Letters over the past year, in addition to over 56 papers published elsewhere. Archival papers dealing with the construction of the experimental facilities in the three halls have been published. The number of Ph.D. projects completed to date at JLab is 210 (up by 18 in the past six months), with an additional 193 projects in progress.

Turning to accelerator operations, in the second-half year of FY05 there were 22 weeks of operation with beam availability of 68.3 %. Hall availability averaged 91% and the multiplicity (the average number of halls scheduled to take data) was 2.25. The expectation of beam delivered to experiments on an annual basis is > 30 weeks.

The physics scope of the proposals presented to PAC28 was again broad. Two themes, however, dominated the requests for beam time. Five proposals are part of the program of deeply exclusive and semi-inclusive experiments to study the nucleon's internal structure at a finer level and three proposals intend to use parity violating (PV) electron scattering to study, by elastic and quasielestic scattering, the strange nucleon form factor and, by inelastic scattering, for the first time the parity-violating inelastic response of the nucleon in the resonance region.

Measurements of parity-violating electron scattering from hydrogen (elastic, both forward and backward angles) and deuterium (quasi-elastic, backward angles) provide information on the strangeness content in the nucleon via the form factors G_{Es} and G_{Ms}, as well as on the neutral-current axial-vector form factor G_A. At present, the indications are that the strangeness form factors are not consistent with zero and that G_A is modified from naïve expectations. Obtaining more stringent constraints on these interesting quantities remains a high-priority goal for studies of hadronic structure.

Experiments in PV inelastic electron scattering covering the resonance region provide new insights into quark-hadron duality, nucleon excitations via axial vector current and the modeling of neutrino cross sections.

Polarized semi-inclusive deep-inelastic scattering (SIDIS) is a powerful tool to determine the polarized parton distributions. Such experiments address questions of the flavor asymmetry of the polarized light quark sea and, indirectly, of the orbital angular momentum of quarks. Deeply exclusive experiments constrain functions within the formalism of the General Parton Distributions (GPD).

Three proposals address questions on nuclei via inelastic electron scattering: First, the (e,e`p) reaction on ^{208}Pb, investigating issues like spectroscopic factors, long-range correlations and dynamic relativistic effects, second, a precision measurement of longitudinal and transverse response functions of quasi-elastic electron scattering and an extraction of the Coulomb sum rule from the data, and third, the extension of studies of hypernuclei over a wide mass region.

The quest for a better understanding of the small wave function components of ^{3}He provides the motivation for an experiment investigating the reaction ^{3}He(e,e`d).

A measurement of the Gerasimov-Drell-Hearn integral at low Q^2 on the neutron and the deuteron would extend the data set into the low Q^2 region for the neutron.

The proposal, Measurement of $R=\sigma_L/\sigma_T$ on Deuterium in the Nucleon Resonance Region, asks for the allocation of remaining beam time of an ongoing experiment.

The proposal, Low Energy Deuteron Photodisintegration, asks for beam time in a parasitic mode running concurrently with G0`s low energy run. This opens up an opportunity to measure polarization observables, so far not yet measured.

Recommendations

Of the fifteen proposals received, nine experiments were approved, two of them conditionally. The ratings for these nine proposals were one with A, seven with A^-, and one with B^+. Three experiments have been deferred with regret.

The PV scattering program on the proton at JLab reached an exciting as well as a critical phase. Having seen the data from the forward scattering runs of G0 and faced with a request for 140 days of beam time in two proposals, the PAC was convinced that an opportunity appears to have arisen where the JLab program in PV eN scattering can tighten the constraints on G_{Es}, G_{Ms} and G_A. G0 at backward angles using hydrogen and deuterium provide G_{Ms} and G_A, and together with forward-angle measurements including the tightest constraints from the measurements proposed in PR05-109, can lead to a much better determination of G_{Es} as well. However, this requires a coherent approach from the two collaborations in the two proposals. Accordingly the PAC recommends that an optimized physics strategy be developed by the proposers of PR05-108 and PR05-109 for how to achieve these goals. That common strategy should be reviewed by the PAC. Thus, PR05-108 and PR05-109 have been approved conditionally.

The PAC approved four experiments in Hall A for a total of 85 days: PR-05-102, Measurements of A_x and A_z Asymmetries in the Quasi-elastic $^3\vec{\mathrm{He}}(\vec{e},e'd)$ Reaction, for 15 days; PR-05-103, Low Energy Deuteron Photodisintegration, for 14 days; PR-05-109, A Measurement of Nucleon Strange Form Factors at High Q^2, for 30 days; PR-05-103, which will run parasitically with G0's low-energy run in summer 2006; and PR-05-110, Precision Measurement of Longitudinal and Transverse Response Functions of Quasi-Elastic Electron Scattering in the Momentum Transfer Range 0.55 GeV/c<q<0.9GeV/c, for 26 days.

Two experiments have been approved in Hall B for 120 days: PR-05-113, Semi-Inclusive Pion Production with a Longitudinally Polarized Target at 6 GeV, for 60 days; and PR-05-114, Deeply Virtual Compton Scattering at 6 GeV with Polarized Target and Polarized Beam Using the CLAS Detector, for 60 days. Both experiments can run concurrently.

Three experiments have been approved in Hall C for a total of 84 days: PR-05-108, G0 Backward Angle Measurements, for running during the special 12-week (~50 PAC days) low-energy running period anticipated for summer, 2006, PR-05-115, Spectroscopic Investigation of Λ Hypernuclei in the Wide Mass Region using the $(e,e'K^+)$ Reaction, for 20 days and PR-05-101, Initial State Helicity Correlation in Wide Angle Compton Scattering, for 14 days.

The laboratory guidelines provided for the approval of 54 days of beam time in Hall A, 60 days of beam time in Hall B, and 9 days of beam time in Hall C. Starting with PAC 24, the formula for these guidelines has been modified, and is based on three components: 30/30/0 days of new time to be made available in Halls A/B/C, plus 100%/100%/100% of the time recovered from approved experiments now required to return to the PAC due to the jeopardy process, and 0%/0%/50% of the days under target in the halls. The PAC is allowed to exceed the laboratory guidelines if it believes the physics has sufficiently high priority, that is at a rating of A- or better, but the excess would then be deducted from the allocation of the next PAC meeting.

The jeopardy process continues to evolve at JLab. At this meeting 24 days of approved time in two proposals were under jeopardy status, 15 in Hall A and 9 in Hall C. The backlog in Hall A is now about 5,2 years, while the backlog in Hall B is 2.6 years and that of Hall C 4.5 years. The requests for beam time in Hall A and Hall C at this meeting were far beyond the allocation. Given so many outstanding proposals the PAC exceeded the laboratory guidelines in Hall A by 31 days and in Hall C by 25 days. The extra low energy running for G0 and PR-05-103 in summer 2006 has not been taken into account in those numbers.

The proposal reports and the PAC recommendations for the reviewed proposals and the response to the letter of intent are given in Appendices D and E. The tables on the following pages summarize the status of the JLab commitments from PAC 4-PAC 28.

The PAC is very appreciative of the efforts of the Hall leaders and the Laboratory staff in support of the PAC meeting and review process. The TAC reports continue to be a very important ingredient in the process of evaluation of proposals. The comments provided by the theory group help greatly by putting the proposals in the context of ongoing theoretical work.

The enthusiastic and thoughtful contributions of Karen Owens and Sue Ewing were especially effective in making the PAC process proceed gracefully and with high efficiency.

Berthold Schoch
Chairman, Jefferson Program Advisory Committee

Tables

Totals for PAC 4-28

	Experiments Recommended for Approval	Experiments Recommended for Conditional Approval	Totals
Experiments	166	6	172
Authors	1096	36	1132
Institutions	184	3	187
Countries	30		30

Approved Experiments Totals by Physics Topics

Topic	**Number**	**Hall A**	**Hall B**	**Hall C**
Nucleon and Meson Form Factors & Sum Rules	30	12	6	12
Few Body Nuclear Properties	29	18	6	5
Properties of Nuclei	30	8	11	11
N* and Meson Properties	55	11	33	11
Strange Quarks	22	4	15	3
TOTAL	166	53	71	42

Approved Days and Conditionally Approved Experiments

Hall	**Approved Experiments**					Conditionally Approved Experiments
	# Expts Completed (full/partial)		Days Run	No. Exps in Queue	Days to be Run	
A	34	2	623.5	21	301.4	3
B	55	8	570.0	17	248.8	1
C	26	5	592.9	15	254.6	2
Total	113	15	1786.5	53	804.7	6

APPENDICES

A. PAC 28 Membership

B. Charge to PAC 28

C. PAC 28 Recommendations

D. PAC 28 Individual Proposal Reports

E. PAC 28 Individual Letters-of-Intent Reports

F. Approved Experiments, PACs 4-28, Grouped by Physics Category

(To access Appendix F, go to http://www.jlab.org/exp_prog/PACpage/pac.html)

Appendix A

PAC 28 Membership

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Appendix B

Charge to PAC 28

Jefferson Lab requests that PAC 28:

1) Review both new proposals* and extensions† or updates‡ to previously-approved proposals, and provide advice on their scientific merit, technical feasibility and resource requirements.
2) Recommend one of four actions on each proposal, extension or update:
   - approval,
   - conditional approval status pending clarification of special issues,
   - deferral with regret,
   - deferral, or
   - rejection.

   (There are two types of conditional approval: conditional pending PAC review of open scientific questions; and conditional pending Jefferson Lab management review of open technical issues. In the later case, the PAC should recommend a beam time allocation.)
3) Provide a scientific rating and recommended beam-time allocation for all proposals recommended for approval.
4) Provide comments on letters-of-intent.
5) Comment on the Hall running schedules.

* Previously-approved proposals that have not, within 3 years of PAC approval, been scheduled to run to completion are returned to the PAC for a fresh scientific review. For the purposes of these reviews, the "jeopardy" experiments are to be treated consistently with new proposals.

† Extension proposals are treated as new proposals, and the merits and status of the original proposal are considered only to the extent that they may bear on the relevance and merit of the extension proposal.

‡ In reviewing an experiment update, the PAC will treat the original proposal and any request for changes taken together as a single new proposal and treat the combination in a manner analogous to a previously-approved proposal undergoing a jeopardy review.

Appendix C

PAC 28 Recommendations

Class*/Grade/Days		
A/A-/14	PR-05-101	Initial State Helicity Correlation in Wide Angle Compton Scattering
A/A-/15	PR-05-102	Measurement of Ax and Az Asymmetries in the Quasi-elastic 3He(e,e'd) Reaction
A*/B+/14	PR-05-103	Low Energy Deuteron Photodisintegration
D	PR-05-104	High Energy Neutral Pion Photoproduction
DR	PR-05-105	Impulse Approximation limitations to the (e,e'p) reaction on 208Pb, identifying correlations and relativistic effects in the nuclear medium
DR	PR-05-106	Update Proposal for E02-109: Measurement of R=sigma_L/sigma_T on Deuterium in the Nucleon Resonance Region
DR	PR-05-107	Parity Violating Electron Scattering in the Resonance Region (Res-Parity)
A**	PR-05-108	G0 Backward Angle Measurements
A**	PR-05-109	A Measurement of Nucleon Strange Form Factors at High Q2
A/A-/26	PR-05-110	Precision Measurement of Longitudinal and Transverse Response Functions of Quasi-Elastic Electron Scattering in the Momentum Transfer Range 0.55 GeV/c < q<.9 GeV/c
D	PR-05-111	Measurement of the Gerasimov-Drell-Hearn Integral at low Q2 on the Neutron and Deuteron
D	PR-05-112	The Delta-d Experiment: Constraining d-quark polarization through semi-inclusive spin asymmetry measurements on a polarized 3He target
A/A-/60	PR-05-113	Semi-Inclusive Pion Production with a Longitudinally Polarized Target at 6GeV
A/A/60	PR-05-114	Deeply Virtual Compton Scattering at 6GeV with polarized target and polarized beam using the CLAS detector
A/A-/20	PR-05-115	Spectroscopic investigation of the hypernuclei in the wide mass region using the (e,e'k+) reaction

- A=Approve, C=Conditionally Approve, D=Defer, DR= Defer with Regret, R=Reject

* Run Concurrently with G0

** Conditionally Approve w/PAC Review

Appendix D

Individual Proposal Reports

Proposal: PR-05-101

Scientific Rating: A^-

Title: Initial State Helicity Correlation in Wide Angle Compton Scattering

Spokespersons: Donal Day and Bogdan Wojtsekhowski

Motivation: The aim of this experiment is a measurement of the initial-state helicity correlation A_{LL} for real Compton scattering off protons at wide angles (RCS), thereby allowing for a further test of the dynamical interpretation of RCS at JLab kinematics. This measurement is part of a series of experiments on RCS. Experiment E99-114 has already measured the polarization transfer observable K_{LL} at s=7 GeV^2 and at a c.m.s. scattering angle of 120° and the differential cross section for this energy and three others at a set of scattering angles. The approved experiment E03-007 will extend the measurement of K_{LL} to other angles. The comparison of data on A_{LL} with those on K_{LL} will provide valuable information on the dynamics of RCS. In current dynamical approaches to RCS differences between the two observables can be traced back to quark helicity flip, and hence to quark masses. If these effects are found to be small, as expected, the RCS data can provide unique constraints on 1/*x*-weighted moments of the generalized parton distributions.

Measurement and Feasibility: The proposed experiment uses circularly polarized bremsstrahlung photons emitted by a longitudinally polarized electron beam. The photons will be scattered off a longitudinally polarized NH_3 target and detected in the BigCal calorimeter. The recoil protons will be detected in the HMS spectrometer. This large installation experiment uses standard equipment and is judged to be feasible. The background from Moeller electrons and from π° photoproduction seems to be under control. The A_{LL} parameter will be measured at s=9 GeV^2 and two scattering angles (90° and 140°) with an overall error less than ± 0.10. As a byproduct, A_{LL} will also be measured for the photoproduction of neutral pions.

Issues: Merely due to lack of available beam time, the PAC recommends that only the kinematic point in the backward hemisphere be measured.

Recommendation: Approve for 14 days in Hall C

Proposal: PR-05-102

Scientific Rating: A$^-$

Title: Measurements of A_x and A_z Asymmetries in the Quasi-elastic $^3\vec{He}\left(\vec{e},e'd\right)$ Reaction

Spokespersons: Shalev Gilad, Douglas Higinbotham, Wolfgang Korsch, Blaine Norum, and Simon Širca

Motivation: The goal of the proposal is to study the small wave function components of ^{3}He, specifically the S′ and D states. Better knowledge of these components is a prerequisite for the calculation of the nuclear corrections that need to be applied to polarized ^{3}He data for the extraction of neutron properties. It is proposed to measure simultaneously the doubly-polarized asymmetries A_x and A_z of ^{3}He for the $\left(\vec{e},e'p\right)$ and $\left(\vec{e},e'd\right)$ channels. Predictions of A_x and A_z based on Faddeev calculations by the Bochum/Krakow and Hannover groups show distinct differences for the proton and deuteron channels as a function of the missing momentum, p_m, and the amount of S′ and D wave components in the bound state wave function. At the same time a measurement of G_E^n at Q^2=0.36 (GeV/c)^2 will be performed with an accuracy of better than 0.0039.

Measurement and Feasibility: The Hall A polarized target is used with HRSℓ for detection of the scattered electron in coincidence with BigBite for the knocked out proton/deuteron. Particle identification in BigBite is performed by means of $\Delta E/E$ in two successive scintillator planes. The three-momentum and energy transfer amount to 620 MeV/c and 106 MeV, respectively, such that real pion production followed by reabsorption is circumvented. The $\left(\vec{e},e'n\right)$ coincidences will be measured between HRSℓ and a neutron detector behind BigBite. The product of beam and target polarization is monitored with HRSr in which A_{elas} will be measured continuously. The asymmetry data will be grouped in parallel and perpendicular subsets that will cover the p_m-range (0, 200) and (-200,200) MeV/c, respectively. The projected statistical precision will be sufficient to discriminate between the presently available theoretical predictions.

Issues: Due to the addition of the proton channel and the data point for G_E^n the proposal has gained considerably in potential since its original approval as E02-108 by PAC22. The two sets of doubly-polarized asymmetries A_x and A_z, as a function of p_m, would add significantly to the possibility to test the Faddeev methods and ultimately reduce the uncertainty in nuclear corrections applied to data of experiments that use polarized ^{3}He as an effective neutron target.

Recommendation: Approve for 15 days in Hall A

Proposal: P-05-103

Scientific Rating: B+

Title: Low Energy Deuteron Photodisintegration

Spokespersons: Ron Gilman

Motivation: It is proposed to study polarization observables in the photodisintegration of the deuteron using photons at a single energy that falls within the range of 360 to 500 MeV.
A plethora of data exists for deuteron photodisintegration for both polarized and unpolarized observables. At 300 MeV, agreement with modern state-of-the-art hadronic calculations is generally good, with perhaps some inconclusive trouble with p_y. The reasons for progress in this area include improvement in the treatment of relativistic effects and the use of modern high-precision NN potentials.
At higher energies, however, it is clear that existing calculations do not describe the data well. The data at higher energies are also often of fairly poor quality.
The impressive agreement of modern calculations, based on hadronic degrees of freedom, with much of the existing data for photodisintegration of the deuteron makes the proposed experiment all that much more interesting. Obtaining high quality data on polarization observables at an energy in the suggested range would be of great value for better understanding the dynamics of the deuteron and the NN-interaction.

Measurement and feasibility: The proposed experiment will use the HRS with the focal plane polarimeter. The configuration will be nearly identical to that used during E89-019 in which the same polarization observables as proposed here were measured in the energy range of 0.5 – 2.4 GeV. Thus, in terms of the setup in Hall A, there is little doubt that the experimental goals can be achieved. The proposed experiment can run parasitically with G0's low-energy run, thus representing a particularly attractive opportunity. Running two halls simultaneously at such low energies, however, represents something of a challenge, although the accelerator group appears both confident and willing.

Recommendation: Approve for 14 days in Hall A

Proposal: PR-05-104

Scientific Rating: N/A

Title: High Energy Neutral Pion Photoproduction

Spokespersons: Ronald Gilman and Bogdan Wojtsekhowski

Motivation: It is proposed to investigate the applicability of the handbag mechanism in the photoproduction of neutral pions at photon energies around 5 GeV and –t around several GeV^2 through polarization observables. Existing data comprise cross sections and recoil polarization components up to 4 GeV, partially taken by the authors of the proposal in previous experiments E94-012 and E99-114. In the π^0 photoproduction background of their real Compton scattering data at 3.2 GeV they find compatibility of the observed polarization transfer K_{LL} to the proton with a calculated polarization transfer to a quark. On this basis they argue that neutral photoproduction with its high cross section might advantageously be used to investigate the onset of hard scattering and to extract three well defined form factors as valuable inputs for the determination of GPDs. As a side effect the polarization data would allow a confrontation with the recoil polarization as observed in $K^+\Lambda$ production of Hall B data.

Measurement and Feasibility: The experiment would be performed in Hall A, using circularly polarized untagged photons hitting a 15 cm liquid hydrogen target. The exclusive reaction would be identified by coincident detection of both decay photons of the π^0 in the newly available BigCal Calorimeter, providing an acceptance of typically 50 % as well as the proton in one of the HRS spectrometers. The differential production cross section and all 3 components of the polarization of the recoiling proton (p_y, K_{LL} and K_{LS}), analyzed in the double layer focal plane polarimeter (FPP) of HRS, would be measured. Based on previous polarization experiments at lower energies, performed by the authors with the detection of only one decay photon, the experiment appears feasible as proposed.

Issues: While the study of photoproduction of neutral pions in the proposed energy regime is considered interesting in itself as a tool to explore and identify the active degrees of freedom, the PAC finds it unlikely that the complicated behavior of the recoil polarization observed below 3 GeV would rapidly turn over to a smooth shape compatible with the handbag mechanism. More than for purely photonic reactions, it is felt that for pion photoproduction stronger proofs are required, particularly a successful description of the cross section in the GPD framework. This could be attainable more convincingly at higher photon energies and make the proposed pion production a more compelling case.

Recommendation: Defer

Proposal: PR05-105

Scientific Rating: N/A

Title: Impulse Approximation limitations to the (e,e′p) reaction on ^{208}Pb, identifying correlations and relativistic effects in the nuclear medium

Spokespersons: Arun Saha, Konrad Aniol, Bodo Reitz and Jose Udias

Motivation: Spectroscopic factors of ≈70% for valence orbits have been extracted from (e,e′p) experiments at intermediate-energy facilities on a variety of nuclei such as ^{7}Li, ^{12}C, ^{16}O, ^{40}Ca, ^{90}Zr and ^{208}Pb. However, the kinematical conditions at which these experiments were performed were not ideal. With the presently available equipment in Hall A the optimal experiment can be performed: in (q,□)-constant kinematics at a three-momentum transfer of 1 GeV/c and x_B=1. The contributions of the transitions to the low-lying states in ^{207}Tl will be separated by fitting the spectra as a function of missing energy, E_m, and missing momentum, p_m, up to 500 MeV/c. These results will be compared to non-relativistic and fully relativistic distorted wave calculations and spectroscopic factors of the $3s_{1/2}$, $2d_{3/2}$, $1h_{11/2}$, $2d_{5/2}$ and $1g_{7/2}$ orbits will be determined. The role of long-range correlations at high p_m will be addressed. Moreover, it is proposed to extract the transverse-longitudinal asymmetry, A_{TL}, at p_m=100, 200 and 300 MeV/c. This response is predicted to be sensitive to dynamic relativistic effects that enter the calculations via an enhancement of the lower components of the Dirac spinors.

Measurement and Feasibility: The two high-resolution spectrometers of Hall A will be used in their standard configuration. The cooled target setup, developed and tested for E03-011, consists of a 0.2 mm thick lead foil that is sandwiched between 2 diamond foils of 0.15 mm each. Beam currents up to 100 □A seem feasible. For the fitting procedure, a dedicated (e,e′p) measurement will be performed on ^{207}Bi to determine the E_m-spectrum of an isolated transition. Count rate estimates and Monte Carlo simulations of the missing-energy resolution indicate that it will be possible to separate the contributions of the 5 lowest states up to p_m=300 MeV/c.

Issues: Extraction of the spectroscopic factors of the 5 valence orbits of ^{208}Pb from (e,e′p) data collected under optimal kinematical conditions is a prerequisite for solving the longstanding issue in the many-body physics of depletion. Since inevitably it is extremely difficult at such high energies to separate completely the individual states, procedures for fitting simultaneously the response as a function of E_m and p_m, should be further developed.

Recommendation: Defer with regret

Proposal: PR-05-106

Scientific Rating: N/A

Title: Measurement of $R = \sigma_L / \sigma_T$ on Deuterium in the Nucleon Resonance Region (Update of E02-109)

Spokespersons: M.E. Christy, C. Keppel

Motivation: The transverse-longitudinal structure functions F_1 (x,Q^2) and F_L (x,Q^2) would be extracted using the Rosenbluth technique in the resonance region ($1 < W^2 < 4$ GeV^2) spanning the Q^2 range $2 < Q^2 < 5$ GeV^2. This measurement adds unique information on the deuteron and the neutron and is critical in several aspects. It allows for the determination of the neutron singlet and non-singlet (proton-neutron) combination of the moments of the F_L structure function. These moments are dominated by the large *x* (resonance) data proposed in this experiment and provide a benchmark test for Lattice QCD calculations at Q^2 above 2 GeV^2. Using duality, which seems to work quite well on the proton, these precision data will add information on the down quark parton distributions at large *x* and moderate Q^2. Furthermore, a precision measurement of R is needed for the determination of the deuteron and neutron spin structure functions g_{1d} and g_{1n} in the resonance region. These data are also relevant to neutrino experiments like MINERVA and MINOS.

Measurement and Feasibility: This experiment would be performed in Hall C using the HMS spectrometer to detect scattered electrons. Part of this previously approved experiment has already been performed at $Q^2 = 0.5$ and 2 GeV^2. The collaboration has all the tools and expertise to reach the quoted uncertainties on the ratio R. Similar precision has been achieved in the proton measurement of experiment E94-110 by the same collaboration. The quoted error bars in the extraction of F_L and R in the deuteron are realistic.

Recommendation: Defer with regret

Proposal: PR 05-107

Scientific Rating: N/A

Title: Parity Violating Electron Scattering in resonance Region (Res-Parity)

Spokespersons: Peter Bosted, J. Arrington, V. Dharmawardane, H. Mkrtchyan, X. Zheng

Motivation: The proposal is aimed at measuring Parity Violating asymmetries on various targets, over the full resonance region (up to a missing mass W = 2.1 GeV) in the Q^2 domain 0.5 - 1.0 $(GeV/c)^2$. The physics addressed by this proposal ranges from quark-hadron duality and EMC-type effects, inputs to key neutrino experiments and inputs (background and radiative corrections) to PV measurements such as E-158 or DIS-Parity. This proposal was examined by PAC27 (PR05-005) and was deferred with regrets.

Measurement and Feasibility: The experiment is proposed for Hall A (versus Hall C for the proposal to PAC27) and requests 15 days in total (including about 1 day contingency). It uses basically the same equipment as that required by the approved E05-007 (DIS-Parity experiment). The proposal has gained experienced collaborators and the DIS- and Res-Parity collaborations are foreseen to work together on the necessary developments (upgraded Compton polarimeter, Fast DAQ, …). The key elements of the experimental set-up are the 2 HRS spectrometers, cryogenic target (25 cm long) for H and D, a polarized electron beam with PV quality and a fast acquisition system allowing for a counting method to reject pion background. Concerning the beam, the size of the asymmetry to be measured is large (50-100 ppm) and the beam performances achieved at JLab exceed the requirements of the proposal. The beam energy and spectrometer settings have been optimized (no septum, energy large enough to scan the missing mass region with adequate cross sections) leading to the choice of a 4.8 GeV beam and a 12.5° detection angle for the scattered electrons. Beam intensity requested is 85 μA, with 80% polarization.

Concerning the recommendations and concerns expressed on PR05-005, PAC28 acknowledges the progress that has been made in the experimental device and in the extension of the physics case presented in the new proposal, in particular the importance of including the nuclear target. The last adds the feature of providing information of value for neutrino oscillation experiments and for a first glimpse at how the EMC effect for PV may be manifested --- these features in particular drew a favorable response from the PAC.

Issues: Despite all of these improvements, the constraints in beam time allocation did not allow the PAC to recommend approval of PR05-107 at this time. A future proposal containing clearer links with the approved and deferred phases of the DIS-parity experiment would help in making a convincing case for approval to explore the various features proposed here in PR05-107.

Recommendation: Defer with regret

Proposal: PR 05-108

Scientific Rating: A^-

Title: G0 Backward Angle Measurements

Spokespersons: Douglas Beck

Motivation: Measurements of parity-violating electron scattering from hydrogen (elastic, both forward and backward angles) and deuterium (quasi-elastic, backward angles) provide information on the strangeness content in the nucleon via the form factors G_{Es} and G_{Ms}, as well as on the neutral-current axial-vector form factor G_A. At present, from determinations of the PV asymmetry at JLab (G0 forward, HAPPEx forward), MIT/Bates (SAMPLE, backward angles) and Mainz (PVA4 forward), the indications are that the strangeness form factors are not consistent with zero and that G_A is modified from naïve expectations. Obtaining more stringent constraints on these interesting quantities remains a high-priority goal for studies of hadronic structure.

Other on-going efforts at JLab (HAPPEx-H and HAPPEx-He) and at Mainz with backward-angle running, together with the first phase of backward-angle running with G0 (799 MeV, $Q^2 = 0.8$ $(GeV/c)^2$ scheduled to begin running in March, 2006 and conclude in the fall of 2006) will further tighten the constraints on the form factors. However, a strong case is being made by the G0 collaboration in the present low-energy proposal (see below) and by the Hall A HAPPEx collaboration in proposal PR05-109 that an opportunity exists at JLab to have an even greater impact in the attempts to determine G_{Es}, G_{Ms} and G_A.

The present proposal requests approval for the remaining time to complete the G0 parity program at backward angles with beam energies of 360 MeV ($Q^2 = 0.23$ $(GeV/c)^2$) and 585 MeV ($Q^2 = 0.48$ $(GeV/c)^2$) with hydrogen and possibly with deuterium as well. Specifically, the collaboration requests scheduling for summer, 2006. For this period a window of opportunity appears to have arisen in which, together with FEL operation, it may be possible to have low-energy running with parity-quality beam for the 40-50 days of summer operation. Normally the accelerator would not be available at all for the nuclear physics program.

Measurement and Feasibility: For running at backward angles the collaboration has concluded that there are significant practical and experimental advantages to running with a standard 499 MHz bunch structure, rather than the 31 MHz structure used for the forward-angle measurements. This will permit higher beam currents of 80 μA to be employed, thereby reducing the statistical uncertainties in extracting G_{Es}, G_{Ms} and G_A. A new set of scintillator detectors is needed to separate elastic and inelastic events for ep scattering and a Cherenkov detector to discriminate between pions and electrons when running with deuterium. The TAC raised a number of concerns, some of which are discussed below.

Issues: While very positive about the value of what is proposed here, the PAC has concerns about several issues that (1) bear on the overall strategy of the PV measurements proposed and their potential impact on efforts to make definitive determinations of the form factors and (2) relate to technical aspects of the experiment. These two items are dealt with separately.

Physics Strategy. An opportunity appears to have arisen where the JLab program in PV eN scattering can tighten the constraints on G_{Es}, G_{Ms} and G_A. G0 at backward angles using hydrogen and deuterium provide G_{Ms} and G_A, and together with forward-angle measurements including the tightest constraints from the measurements proposed in PR05-109, can lead to a much better determination of G_{Es} as well. However, this requires a coherent approach from the two collaborations in the two proposals. Accordingly the PAC recommends that an optimized physics strategy be developed by the proposers of PR05-108 and PR05-109 for how to achieve these goals. The PAC recommends that a single common value of Q^2 should be chosen. This choice will require discussions of trade-offs in both low- and high-energy parts of the program. For PR05-108

another important issue will be the choice of target: with only hydrogen a full determination at the selected Q^2 point will be impossible and one will have to depend on G_A having a "reasonable" Q^2-dependence between 0.1 $(GeV/c)^2$ and 0.8 $(GeV/c)^2$ where it will be known; with hydrogen and deuterium both G_{Ms} and G_A can be determined, however with poorer precision given a fixed amount of beamtime. An optimized, coherent strategy should be presented at PAC29 for final approval and should include a detailed analysis of the impact of following alternative strategies on the ultimate error ellipses to be expected in the determinations of G_{Es}, G_{Ms} and G_A. In summary, the PAC recommends that the G0 collaboration work with the Laboratory and the HAPPEx collaboration to choose an optimal common experimental strategy based upon the additional information that is (or soon will be) available for this important class of measurements.

Technical Issues. The TAC raised a number of technical issues concerning installing, commissioning, and running the G0 low-energy back-angle experiment. In order to address these issues, the collaboration is asked to work with the Laboratory to develop:

1. A well motivated table of beam requirements including halo, helicity-correlated modulations, intensity, and polarization.
2. Detailing of detector and apparatus performance criteria.
3. Discussions of background criteria including radiation levels at detectors.
4. A run plan including
    a. milestones and times for achieving 1, 2, and 3.
    b. count rates and running times to achieve statistical uncertainties.
    c. auxilary measurements and times to control systematic uncertainties.

Recommendation: Conditionally approve (C2) for running during the special 12-week (~50 PAC days) low-energy running period anticipated for summer, 2006.

Proposal: PR 05-109

Scientific Rating: A-

Title: A Measurement of Nucleon Strange Form Factors at High Q^2

Spokespersons: Kent Paschke, Paul Souder

Motivation: The proposal is aimed at measuring with high precision a combination of electric and magnetic strange form factors at $Q^2 = 0.6$ $(GeV/c)^2$. The anticipated uncertainty would allow a 4-σ confirmation of a non-zero strange contribution signal if observed at the level reported by the G0 experiment. As discussed below, the high-precision forward-angle measurement together with backward-angle measurements on the H and D targets (proposed by G0) at a common Q^2 would provide a complete determination of G_{Es}, G_{Ms}, and G_A at that Q^2.

Measurement and Feasibility: The experiment is proposed in Hall A for 30 days total. The experimental set-up uses the one that was previously successful for the HAPPEx I and II experiments. Most of the concepts and equipment have been used and tested in the earlier data taking. Most of the experimental specifications have been met in earlier phase of HAPPEx, in fact in HAPPEx II they were exceeded by almost an order of magnitude. The polarized electrons will be produced either by the super-lattice or strained GaAs cathode (75-85% polarization). The beam intensity required is 100 μÃ . This proposal makes use of the 2 HRS spectrometers to detect the elastically scattered electrons on a 20-cm-long liquid hydrogen target. The dedicated detectors will be placed in the focal plane of the HRS and the PMT signal will be. Key elements and challenges of the set-up will be the polarization measurement with the Hall A Compton polarimeter, which will need an upgrade already planned for future high-precisions PV experiments. Also, target boiling should be kept under control. The proponents are seeking a precision (statistics and systematic) about a factor 2-3 better than obtained earlier in the same momentum transfer region. This is quite demanding concerning any kind of systematic or theoretical uncertainties and this is where the difficulties reside. These difficulties include form factor knowledge and the contribution of 2-photon exchange, polarization measurement with a 1 % precision, etc.

While very positive about the value of what is proposed here, the PAC has concerns about the *Physics Strategy.* An opportunity appears to have arisen where the JLab program in P-V eN scattering can tighten the constraints on G_{Es}, G_{Ms} and G_A. G0 at backward angles using hydrogen and deuterium provides G_{Ms} and G_A and together with forward-angle measurements including the tightest constraints from the measurements proposed in PR05-109, can lead to G_{Es} as well. However, this requires a coherent approach from the two collaborations in the two proposals. Accordingly the PAC recommends that the Laboratory and the proponents of PR05-108 and PR05-109 develop a common strategy to achieve these goals. A single common value of Q^2 should be chosen. This choice will require discussions of trade-offs in both low- and high-energy parts of the program. For PR05-108 another important issue will be the choice of target: with only hydrogen a full determination at the selected Q^2 point will be impossible and one will have to depend on G_A having a "reasonable" Q^2-dependence between 0.1 $(GeV/c)^2$ and 0.8 $(GeV/c)^2$ where it will be known; with hydrogen and deuterium both G_{Ms} and G_A can be determined, however with poorer precision given a fixed amount of beamtime. The common strategy should be reviewed by the PAC.

Recommendation: Conditional approval (C2) for 30 days in Hall A

Proposal: PR 05-110

Scientific Rating: A^-

Title: Precision Measurement of Longitudinal and Transverse Response Functions of Quasi-Elastic Electron Scattering in the Momentum Transfer Range 0.55 GeV/c<q<0.9GeV/c

Spokespersons: Seonho Choi, Jian-Ping Chen and Zein-Eddine Meziani

Motivation: The goal of the proposed measurements is to extract the longitudinal and transverse response functions for inclusive, unpolarized, quasi-elastic scattering from a variety of targets (^{4}He, ^{12}C, ^{56}Fe, ^{208}Pb) at momentum transfers ranging from q = 0.55 to 0.9 GeV/c. Integration of the longitudinal part yields the Coulomb sum. Previous determinations in all but very light nuclei suggest that significant quenching occurs, although those results do not extend to very high momentum transfers where effects from Pauli blocking and some types of correlations are expected to be diminished. By extending the previous separations to higher values of q, it is hoped that the resulting longitudinal response and its accompanying Coulomb sum will shed light on the issue of whether or not other effects are required to reconcile the predictions of standard modeling with experiment.

Measurement and Feasibility: The earlier version of this proposal came under jeopardy review at the time of PAC25 and was deferred for two reasons: (1) concerns existed with respect to the lack of unanimity in the theory community of how to handle Coulomb distortion effects for quasi-elastic scattering and (2) the fact that simulations allowing one to arrive at projections for the uncertainty expected in the Coulomb sum were not available.

Both of these concerns have extensively been addressed by the proposers. Firstly, two workshops have been organized, focusing on the issue of inter-relating the various theoretical approaches to treating Coulomb distortion effects, especially at intermediate energies and for heavy nuclei. Much progress has been made; the theory community has become quite active; and it appears that a consensus is within reach, likely at roughly the 10% level or better. Secondly, the proposers have performed simulations and produced realistic projections for the uncertainties to be expected for the Coulomb sum, as requested.

Issues: Beyond the previous issues discussed above, which appear to have been dealt with, the proposers were asked about potential backgrounds and their impact on the L/T separation. Dedicated analysis has shown that the major source of background originates at Q3 in the HRS, which can be suppressed adequately. Moreover, additional suppression will be obtained by means of information from a PbF_2 calorimeter. Therefore it appears that the goals of the experiment can be met.

Recommendation: Approve for 26 days in Hall A

Proposal: PR 05-111

Scientific Rating: N/A

Title: Measurement of the Gerasimov-Drell-Hearn Integral at low Q^2 on the Neutron and Deuteron

Spokespersons: Alexandre Deur, Gail Dodge and Karl Slifer

Motivation: The proposal aims at measuring the generalized ($Q^2 \neq 0$) GDH integral for the deuteron at Q^2 down to 0.01 $(GeV/c)^2$ in a Hall B experiment using the CLAS detector and a polarized deuterium target (ND_3). By combining the results with the approved experiment on the proton target (NH_3) in Hall B (E03-006), this proposal should allow the determination of this integral and therefore a test of the GDH sum rule on the neutron at Q^2 close to 0. This will complement data of a similar but less accurate experiment (EG1b) already performed in Hall B at Q^2 above 0.05 $(GeV/c)^2$.

Measurement and Feasibility: The experiment is proposed in Hall B for 30 days. The experimental set-up uses the CLAS detector with a new Čerenkov counter for absolute normalization. The polarization of electrons is assumed to be 80 % and a beam current of 1-4 nA is required. This proposal relies on the operation of a polarized solid target (ND_3) with 40% deuteron polarization. The experimental specifications appear to be reachable with CLAS, which will be used in rather standard operation. The new Čerenkov counter is under construction for E03-006 and will be available.
The determination of the sum rule for the deuteron will include the disintegration channel which is large below pion threshold where the elastic channel also contributes.
The extraction of the neutron GDH integral relies on nuclear corrections which are not small in the case of a deuteron target. It will make use of the combination of data from this proposal and from the proton data (E03-006) which will cover about the same kinematics.

Issues: The beam and target polarizations used in the proposal might be too high and safer values of 75% and 30% have been assumed respectively. The PAC recognized the great importance of the measurement of the GDH sum rule for the neutron at very low Q^2 which will also allow an extrapolation to the photon point. However, an experiment (E97-110) has already collected data in Hall A with a polarized ^3He target which provides a cleaner source of polarized neutrons. The present proposal offers no large improvement in accuracy and only a moderate extension towards lower Q^2 with respect to the projected E97-110 results. Therefore it will be important to wait for the results of E97-110 for a better judgment of the need for an additional measurement with a nuclear target (ND_3 instead of ^3He).

Recommendation: Defer

Proposal: PR 05-112

Scientific Rating: N/A

Title: The Δd Experiment: Constraining d-quark polarization through semi-inclusive spin asymmetry measurements on a polarized ^{3}He target

Spokespersons: Xiaodong Jiang

Motivation: Polarized semi-inclusive deep-inelastic-scattering (SIDIS) is a powerful tool to determine the polarized parton distributions. The present knowledge of the latter is by far less accurate than that of the unpolarized ones. In particular the sea-quark polarized distributions are poorly constrained by present SIDIS data and by global analyses based on QCD fits; it is not clear whether or not the polarized light-quark sea is flavor asymmetric, like the unpolarized one, if true a fact with very important consequences. The goal of this proposal is to measure the SIDIS asymmetry for charged pions (and kaons) on a polarized ^{3}He target which is mainly sensitive to the d-quark polarization. A combined LO analysis of the results of this experiment with the ones from the approved semi-SANE experiment will be needed for the extraction of the polarized distributions, including the $\Delta\bar{d}$ - $\Delta\bar{u}$ difference.

Measurement and Feasibility: The proposed measurement would use a 6 GeV polarized beam on a longitudinally polarized ^{3}He target. The scattered electrons would be detected with the BigBite spectrometer positioned at 30^o. The electro-produced hadrons will be measured by the left-HRS located at 6^o with its septum magnet in front. Pions and kaons of both charges will be identified. The semi-inclusive asymmetries will be measured in the *x* region 0.12 - 0.41 and at Q^2 =1.2 – 3.1 GeV^2. This measurement appears feasible.

Issues: The PAC recognizes the compelling case for the determination of the polarized parton densities at large-x and in particular the investigation of the flavor asymmetry of the sea-quarks. The present experiment is aiming to provide statistically precise data in this field. However, the statistical accuracy may be spoiled by the uncertainties in the systematic errors which may originate from different sources, namely, combining two data sets from two different experiments, assuming the exact LO factorization and rigorous isospin symmetry and charge conjugation in the fragmentation process. The two latter assumptions may not be completely valid in the kinematic region of this proposal and, therefore, the accurate determination of the small asymmetry of the sea-quark at large x may not be possible. Since the Semi-SANE experiment has already been approved, it will be important to see the outcome of that measurement before demanding a very high statistical accuracy as suggested in the present proposal.

Recommendation: Defer

Proposal: PR-05-113

Scientific Rating: A-

Title: Semi-Inclusive Pion Production with a Longitudinally Polarized Target at 6 GeV.

Spokespersons: H. Avakian, P. Bosted, D. Crabb, K. Griffioen.

Motivation: A measurement of the single- and double spin azimuthal asymmetries in semi-inclusive electroproduction of pions using the 6 GeV polarized electron beam on a longitudinally polarized proton target with the CLAS detector equipped with the Inner Calorimeter is proposed. Spin dependent parton distributions and in particular the transverse momentum dependent ones will be studied in SIDIS at $Q^2 > 1$ GeV^2. Both the sin2φ and the sinφ azimuthal moments of the target spin-dependent cross section will be determined. They will probe the Collins fragmentation function and higher twist effects in single spin asymmetries. Indirectly, information about orbital angular momentum of quarks will also be provided.

Measurement and Feasibility: The study involves a simultaneous scan of several observables (x, Q^2, z, p_T and φ), possible with the large acceptance of CLAS. A twenty-fold increase of statistics as compared to the existing Eg1 data for the π^0 asymmetries will be achieved with the new IC. This is particularly important because much smaller systematic uncertainties are expected for the neutral pion production as compared to the charged ones since the former are less affected by exclusive ρ meson production. Charged pions asymmetries will be measured as well. A significant sample of two-pion events will be accumulated also and will contribute to better understand the SIDIS as well as the background due to ρ production. The existing CLAS Eg1 data and simulations show that the planned measurements are feasible. No technical problems are foreseen. The experiment will run concurrently with PR05-114 which has the same apparatus and trigger requirements.

Issues: The PAC recognizes the importance of the proposed experiment in view of the intensively developing theory of SIDIS and of the extensive effort towards understanding the transverse aspects of the spin structure of the nucleon (both parton distributions and fragmentation) which will be carried out in other laboratories: CERN (COMPASS), DESY (HERMES) and KEK (BELLE).

Recommendation: Approve for 60 days in Hall B

Proposal: PR-05-114

Scientific Rating: A

Title: Deeply Virtual Compton Scattering at 6 GeV with Polarized Target and Polarized Beam Using the CLAS Detector

Spokespersons: Latifa Elouadrhiri, Angela Biselli, Kyongseon Joo, Silvia Niccolai

Motivation: The principal goal of this experiment is a precise measurement of the single-spin asymmetry A_{UL} in Deeply Virtual Compton Scattering (DVCS) from a longitudinally-polarized hydrogen target. Previous measurements of several DVCS asymmetries by both the CLAS and HERMES collaborations, at similar kinematics to those of the proposed experiment, have been well described by the "handbag diagram" and the Generalized Parton Distribution (GPD) formalism. In this formalism, the substructure of the nucleon is described by two helicity-conserving functions $H^q(x,\xi,t)$ and $E^q(x,\xi,t)$ and two helicity-flip functions $\tilde{H}^q(x,\xi,t)$ and $\tilde{E}^q(x,\xi,t)$ (the index q indicates quark flavor). The measurement of hard-exclusive processes, such as DVCS, is the key to constraining these functions at off-forward kinematics. For example, the DVCS beam-spin asymmetry A_{LU} measured by CLAS and HERMES provides information on the GPD H along the off-forward kinematic line $x = \pm\xi$.
This experiment will focus instead on the DVCS target-spin asymmetry. Specifically, the exclusive process $ep \rightarrow ep\gamma$ at hard scales ($Q^2 > 1$ GeV^2) will be measured, with all three final-state particles detected, and the distribution of the final-state photons in the azimuthal angle ϕ (relative to the lepton scattering plane) will be mapped out in both target spin states. The resulting asymmetry $A_{UL}(\phi)$ will be fitted to the functional form $(A \sin(\phi) + B \sin(2\phi))/(1 + C \cos(\phi))$. In the GPD formalism, the $\sin(\phi)$ moment "A" arises from an interference between the DVCS and Bethe-Heitler processes, and is sensitive to a roughly-equal mixture of the GPDs H and $\tilde{H}$ (summed over quark flavors) along the kinematic line $x = \pm\xi$. (The moment also contains a small, < 10%, admixture of the GPD E, while the contribution from $\tilde{E}$ is much further suppressed.) When coupled with the previously measured $A_{LU}^{\sin(\phi)}$ data (sensitive to H alone, along the same $x = \pm\xi$ lines), the data will provide valuable new constraints on $\tilde{H}$.

Measurement and Feasibility: A_{UL} for DVCS has already been measured, by both CLAS and HERMES, but the proposed experiment offers much higher statistical precision than either data set. Compared with the previous CLAS result, this experiment will collect about 25 times more data: the requested running time of 60 days is more than an order of magnitude larger than the duration of the previous data set, and the recent addition of the Inner Calorimeter (IC) offers an acceptance gain of roughly a factor of 2. This statistical gain will permit an exploration of the *kinematic-dependence* of the $A_{UL}^{\sin(\phi)}$ moment on x (0.12 – 0.48), $-t$ (0.1 – 0.6 GeV^2), and Q^2 (1 – 4 GeV^2), with 5 bins in each variable. The ability to measure the Q^2 dependence is particularly important, as it will help to establish whether or not the scaling region has been reached, and to constrain the size of power corrections. It is also important to note that HERMES will not collect any further data with longitudinally-polarized target, and that the experiment will additionally measure the SSA moment $A_{UL}^{\sin(2\phi)}$ (sensitive to higher-twist effects) and the double-spin asymmetry moment $A_{LL}^{\cos(\phi)}$ (sensitive to a principal-value integral over x of H and $\tilde{H}$).

The CLAS collaboration has already published several results on DVCS azimuthal asymmetries, and no particular new challenges are foreseen with the proposed experiment. The only instrumental change is the IC, but its successful operation has already been demonstrated. The principal experimental issue for this measurement is the successful treatment of non-exclusive background. Four sources of such background may be identified:

1. $ep \rightarrow ep\gamma\gamma$, where the second photon arises from QED radiation
2. $ep \rightarrow ep\pi^0$ with the π^0 decaying to two photons

3. scattering from the nucleons of the weakly-polarized ^{14}N component of the $^{14}NH_3$ target
4. electrons or positrons misidentified as photons in the IC (which cannot differentiate)

The proposal presents two powerful cuts to eliminate these backgrounds, both based on the fact that all three final-state particles will be detected: the scattered beam-electron and target-proton in CLAS, and the photon in either CLAS or the new IC. The most powerful background-reduction cut arises from restricting the angle of the detected final-state photon to within a 1° cone around its calculated position for an exclusive event, given the electron and proton momenta determined by CLAS tracking. The ability to evaluate and subtract this background was clearly demonstrated in the first three cases, and the projected systematic error includes any associated uncertainty. The fourth case has not yet been evaluated, but it is highly unlikely that it is a significant source of background compared with the other three.

Recommendation: Approve for 60 days in Hall B

Proposal: PR-05-115

Scientific Rating: A-

Title: Spectroscopic Investigation of Λ Hypernuclei in the Wide Mass Region using the $(e,e'K^+)$ Reaction

Spokespersons: O. Hashimoto, S.N. Nakamura, J. Reinhold, L. Tang

Motivation: For the past three decades Λ hypernuclei have provided a special laboratory to investigate the Λ-nucleus shell model potential with emphasis on the determination of the ΛN spin-orbit and the ΛN hyperfine interaction. However, the investigation of the ΛN interaction using hadronic probes has long been limited by a poor missing mass resolution and low statistics. This situation has recently changed with a set of experiments performed at Jefferson Lab, especially with E01-011 in Hall C. Taking advantage of the newly achieved technical improvements these important questions can be addressed in a comprehensive manner. With the presently achievable resolutions the $\Lambda\Sigma$ coupling can also be probed by using neutron rich light nuclei.

Measurement and Feasibility: As an extension of E01-011 it is proposed to measure the $(e,e'K^+)$ reaction in ^{51}V and ^{89}Y to produce medium-heavy hypernuclei, namely $^{51}_{\Lambda}$Ti and $^{89}_{\Lambda}$Sr. Furthermore, it is proposed to investigate hypernuclear structure of neutron rich Λ hypernuclei in the following reactions $^{6,7}\mathrm{Li}(e,e'K^+)^{6,7}_{\Lambda}\mathrm{He}$ and $^{10,11}\mathrm{B}(e,e'K^+)^{10,11}_{\Lambda}\mathrm{Be}$. In all reactions, the kaons will be detected in the HKS spectrometer in coincidence with the scattered electrons in the Enge or HES spectrometer (under construction). Preliminary results of E01-011 show that the achieved HKS spectrometer resolution is consistent with the design specifications and that the tilt of the Enge spectrometer, implemented to reduce bremsstrahlung and Moeller induced events, has been successful. The presently achieved signal over accidental rates allows for a high luminosity running consistent with acceptable production rates. The ultimate goal of a missing mass resolution of 300 keV, although not yet demonstrated, appears to be achievable with the present understanding of the Enge spectrometer and its detector package.

Issues: While the Enge spectrometer can be used to perform part of this experiment, the HES spectrometer combined with a new splitter magnet would be a better alternative. Due to its larger central momentum range the HES will give needed flexibility to run this experiment in Hall C in parallel with activities in the other Halls. Furthermore the required resolution for the exploration of the heavy nuclei must reach the stated 320 keV goal so that the signal over background is much improved and thus the required statistics can be better optimized for the available beam time. The collaboration is encouraged to build and test the HES in combination with the new splitting magnet in order to take advantage of the various available beam energies in Hall C and projected improved missing mass resolution.

Recommendation: Approve for 20 days in Hall C

Appendix E

Individual Letter of Intent Reports

Letter of Intent: LOI-05-101

Title: Charged Electroproduction Ratios at High p_T

Spokespersons: Garth Huber

Motivation: It is planned to measure exclusive charged pion electroproduction at large Q^2 and large momentum transfer t, while keeping $-t > Q^2$. There are no data in this kinematical region yet. The theoretical interest in such measurements is to learn about a reaction with two (moderately) large scales, Q^2 and t, and see the eventual onset of the hard scattering regime. The measurement may possibly provide a test of the handbag approach for hard wide-angle reactions from which predictions on the π^-/π^+ cross section ratios for either longitudinally or transversally polarized photons are available. A strong dependence of the cross sections on the photon polarization is expected theoretically. For the ratio of transverse cross sections there also exists a prediction by Nachtmann which holds for small t and large photon virtuality.

Measurement and Feasibility: It is planned to measure the cross sections for $ep \rightarrow e'\pi^+n$, $ed \rightarrow e'\pi^+nn$ and $ed \rightarrow e'\pi^-pp$ at $Q^2 = 2$ GeV^2, W>2 GeV and for six c.m.s. scattering angles, including 90°. The various cross sections allow for an extraction of the one for $\gamma^* n \rightarrow \pi^- p$. The experiment is similar to the pion form factor measurement E93-011. Preliminary data from the latter for scattering angles smaller than 75° and at W = 2 GeV, $Q^2 = 2.5$ GeV^2 indicate the feasibility of the planned experiment.

Issues: Separation of the longitudinal and transverse cross sections is important for a comparison with theory. Two values of ε in the planned experiment will allow a partial separation of the two cross sections. The limited azimuthal coverage, on the other hand, will not allow a separation of the two interference cross sections, σ_{LT} and σ_{TT} from the longitudinal one. Therefore, in a full proposal, the authors should demonstrate the quality of the longitudinal/transverse separation.

Recommendation: The PAC considered this letter of intent with interest and found the planned experiment compelling. It feels, however, that the theoretical understanding of exclusive meson electroproduction for the chosen kinematics is not yet sufficiently well developed. This may prevent an interpretation of the obtained data. The planned experiment seems to fit more into the forthcoming JLab 12 GeV upgrade program.

Letter of Intent: LOI-05-102

Title: Search for Light η-mesic nuclei via recoilless A(e,e´p)

Spokesperson: Liping Gan

Motivation: Here the authors propose to search for nuclei containing a bound η using the reaction $\gamma^* + A \rightarrow p + {}_{\eta}(A - 1)$ with ^{4}He and ^{12}C as targets. At present, any experimental evidence for η-mesic nuclei is inconclusive. If the authors succeeded in producing η-mesic nuclei, this would be a nice discovery. The unambiguous identification of such nuclei would provide our first real understanding of the η N interaction, and would undoubtedly stimulate a great deal of theoretical work.

Measurement and Feasibility: The authors propose an experimental setup closely related to that currently being used by the hypernuclear physics collaboration. The scattered electron would act as a tag for the virtual photon, and would be detected by the HES. The knock-out proton would be detected by the HKS. The authors state that the kinematics are chosen such that the resulting eta/nuclear system is close to recoilless. The π^- and p from the decay of the eta would be detected by a two-arm scintillator telescope oriented perpendicular to the beam in order to reduce background.

It is not at all clear that the suggested kinematics are optimal, and in an eventual proposal, this issue should be addressed in detail. For instance, plots illustrating event rates and background as a function of energy would be quite useful. Furthermore, at least naively, the high resolution of the HKS and HES would seem fairly irrelevant to their search. It is quite possible that it would be advantageous to sacrifice resolution for larger acceptance in the experimental design. Finally, there is a danger that the elements of the scintillator telescope, which are in close proximity to the target, may experience very high.rates or even damage. This issue needs to be looked at carefully, including the possibility that an absorber such as a few millimeters of Pb might be required.

In summary there is a long history of interest in identifying η - mesic nuclei, and indeed, their discovery would be quite valuable. Given the challenge that this has represented to experimenters it is important in an eventual proposal to make a convincing *quantitative* argument explaining why this experiment would succeed where others have failed.

Recommendation: N/A

Letter of Intent: LOI-05-103

Title: The search for non-nucleonic degrees of freedom in the deuteron.

Spokespersons: Dipangkar Dutta, Haiyan Gao, and Roy Holt

Motivation: The authors propose to measure the cross section for dual Δ photo-production in the reaction γd $\rightarrow \Delta^{++} \Delta^{-}$. In particular, they propose to look for a sharp increase in the production cross section for this reaction at short distances due to the onset of QCD effects. At sufficiently short distances, QCD predicts that the six quarks in the deuteron can reorganize and mix into a six-quark color singlet. There are five such states, only one of which is nucleonic in nature. The remaining states are referred to as having hidden color. Thus, if the nucleons are sufficiently close, based on symmetry alone, one would expect a five-fold increase in the cross section for dual Δ photo-production, an effect that would be a striking smoking gun for the emergence of the dominance of quark degrees of freedom. The literature, on the other hand, contains other references suggesting that the ΔΔ component of the deuteron wave function could be far smaller than the suggested 80%. Work by such authors as H. Arenhövel, E. Lomon and F. Khanna are not cited in the LOI's Reference 4b, where the 80% number is suggested. In an eventual full proposal, the relationship between observing dual Δs and the large "hidden color" component of the deuteron wave function should be discussed, and the assumptions upon which this prediction is based should be elaborated further.

Measurement and Feasibility: The authors envision performing the experiment in Hall C using the SOS and HMS spectrometers. The authors have chosen to consider kinematics such that both the π^+ and the proton would be detected by the SOS spectrometer. The Δ^- will decay into a π^- and a neutron, of which the pion will be detected by the HMS. The only background that was identified as an issue is the process $\gamma + d \rightarrow \pi^+ \pi^- p\, n$, for which there is apparently only one measurement that does not provide sufficient information on cross section. For this reason, to estimate their rates, the authors analyzed existing data from Hall B and looked at $\pi^+ \pi^- p$ events. By plotting the invariant mass of the $\pi^+ p$ system versus the missing mass of the same system, the authors state that they have identified a set of events containing dual Δ production, and fit the apparent background. The event and background rates based on these studies suggest that the measurement is feasible. In an eventual proposal, the studies resulting in this conclusion should be more fully discussed There might be an issue with the Coulomb interaction between the proton and the positive pion which will be detected in the small solid angle detector SOS.

Recommandation: N/A

Appendix F

Jefferson Lab Experiments, PAC 4-28, Grouped by Category

(To access Appendix F, go to http://www.jlab.org/exp_prog/PACpage/pac.html)