The Thomas Jefferson National Accelerator Facility (Jefferson Lab) is a national physics user facility Operated by the Jefferson Science Associates, LLC, for the U.S. Department of Energy (DOE)

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Jefferson Science Associates

Thomas Jefferson National Accelerator Facility

March 20, 2008

Members of the Jefferson Lab User Group,

Jefferson Lab and its user community have enjoyed another successful year, with excellent experimental results and publications, progress toward the next milestone for the 12 GeV Upgrade, and the recent appropriation by the Governor and Virginia General Assembly of $6M to support the 12 GeV Upgrade. Our performance, both scientific and managerial has been recognized by the Department of Energy as outstanding, at the top of the Office of Science labs.

The most recent Program Advisory Committee was held January 14-18, 2008, and was again chaired by Roy Holt. The PAC reviewed 25 proposals and 1 Letter of Intent. PAC 33 completed a thorough assessment and ten proposals were approved, nine were conditionally approved, and seven proposals were deferred.

The role that the Program Advisory Committee plays in ensuring that the highest quality science is pursued is invaluable, and I thank them for their dedication. I would particularly like to recognize Barbara Badelek, who is rotating off the committee. Her contributions to the efforts of the PAC to remain focused on the highest impact experiments is appreciated, and I wish her well in her future endeavors.

Sincerely,

Christoph W. Leemann
JSA President
Director, Jefferson Lab

Letter from the PAC Chairman

Introduction

The Jefferson Laboratory Program Advisory Committee held its 33rd meeting on January 14-18, 2008. 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 twenty-five proposals and one letter of intent submitted by JLab users. PAC33 represents the last 6 GeV PAC.

General Overview

Clearly, the demand for beam time is stronger than ever with 25 proposals presented to PAC 33. Against this backdrop, it was especially disappointing to learn that the FY08 budget did not significantly increase funding for operations. Given the remarkable number of exceptional quality 6-GeV physics proposals, the Laboratory and DOE/NP are encouraged to develop a plan that will allow as much as possible of the approved 6-GeV program to be completed before its termination for the Upgrade.

The central goal of JLab is to determine the basic structure of the proton, neutron and nuclei. All three halls made significant progress toward this goal during the past 6 months. Hall A completed the Coulomb sum experiment. Hall B completed the g13 series aimed at photoexcitation of the nucleon and began the g9 (FROST) series. Hall C completed the installation of BIGCAL and the HMS FPP and began recording data for the G_E^p/G_M^p and the two-photon exchange experiments.

The overall JLab program continued to show steady growth; prior to PAC 31 it included 173 approved experiments. To date, 138 full experiments have been completed at JLab. Twenty-seven papers have been published in Physical Review Letters or Physics Letters during the past calendar year, in addition to over 72 papers published in other refereed journals. The number of Ph.D. projects completed to date at JLab is 324, with an additional 224 projects in progress.

The Hall leaders, staff and users are to be commended for keeping the physics program and technical developments on track, especially given the budget situation. Impressive progress has been made on BIGCAL, the HMS FPP, HES, FROST and the Moeller and laser polarimeters.

The accelerator availability has been remarkably high. During the past year, the accelerator operated with a beam availability of 80.6% and an average Hall availability of approximately 92%. The Laboratory management and extra effort from the staff are to be commended for maintaining a relatively high level of operation despite a far from optimal operations budgets. The 6 GeV restoration program is making significant progress. The accelerator group has replaced three of the ten weak cryomodules and is on track for achieving 5.9 GeV by the summer, 2008.

The 12 GeV upgrade has made considerable progress during the past year. The 12-GeV team is to be commended for achieving CD-2 approval and is well on their way to achieving CD-3a approval in the near future. It is especially gratifying that the final FY08 budget is expected to provide essentially full funding for this year's 12-GeV upgrade work.

The Laboratory received an exceptional array of very interesting proposals to be considered by the PAC. Nucleon and nuclear structure studies dominated the requests for beam time. Eleven proposals are part of the program of nucleon structure. Eleven proposals address issues in nuclear

structure or medium modifications, while three proposals were aimed at issues in fundamental physics.

Recommendations

Of the 25 proposals received, nine experiments were fully approved, while one was partially approved. Two experiments were conditionally approved with a technical condition in the C1 category, while six and a part of one proposal were conditionally approved in the C3 category. The ratings for the approved or conditionally approved proposals were two with A, eight with A^-, seven with B^+ and one with B. Five proposals were deferred with regret, while two proposals were deferred. The new C3 category refers to an experiment that should be run if it can be "fit in" to the experiment schedule without impacting planned running of the highest priority experiments (i.e. it uses beam conditions compatible with the planned running in the other halls, requires minimal new equipment construction, and is not delaying installation and running of planned experiments in this hall.).

The PAC approved seven experiments in Hall A for a total of 102 days: PR-08-005, Measurements of the Target Single-Spin Asymmetry A_y in the Quasi-Elastic ^{3}He(e,e'n) Reaction, for no days; PR-08-007, Measurement of the Proton Elastic Form Factor Ratio at Low Q^2, for 14 days; PR-08-010, Measurement of the Coulomb quadrupole amplitude in the $\gamma^*\Delta(1232)$ in the low momentum transfer region, for 3 days; PR-08-11, Polarized e-^{2}H parity violating deep inelastic scattering (PVDIS) at CEBAF 6 GeV, for 32 days; PR-08-014, Three-nucleon short range correlations studies in inclusive scattering for $0.8<Q^2<2.8$ $(GeV/c)^2$, for 12 days; PR-08-025, Measurement of the Deeply Virtual Compton Scattering Cross-Section off the neutron, for 17 days; and PR-08-027, A Measurement of g_2^p and the Longitudinal-Transverse Spin Polarizability, for 24 days.

One experiment was approved and two experiments were conditionally approved (C1) in Hall B for 45 days: PR-08-023, An Updated High Precision Measurement of the Neutral Pion Lifetime *via* the Primakoff Effect, for 20 days; PR-08-015, Transverse spin effects in SIDIS at 6 GeV with transversely polarized target using the CLAS Detector, for no days; and PR-08-021, Deeply Virtual Compton Scattering at 6 GeV with transversely polarized target using the CLAS Detector, for 30 days.

One experiment was approved in Hall C: PR-08-016, The Qweak Experiment: A Search for New Physics at the TeV Scale *via* Measurement of the Proton's Weak Charge, for 198 days.

The laboratory guidelines provided for the approval of 101 days of beam time in Hall A, 45 days of beam time in Hall B, and 120 days of beam time in Hall C. Given the nature of the Qweak experiment, the PAC significantly exceeded the laboratory guidelines in Hall C.

The proposal reports and the PAC recommendations for the reviewed proposals and the responses to the letter of intents are given in Appendices D and E. The tables on the following pages summarize the status of the JLab commitments from PAC 4 through PAC 33.

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 placing the proposals in the context of ongoing theoretical work.

The proponents are to be commended for presenting an outstanding array of very interesting physics proposals. Finally, the enthusiastic and thoughtful contributions of Rachel Harris were essential in making the PAC process proceed gracefully and efficiently.

Roy J. Holt
Chairman, Jefferson Program Advisory Committee

Tables

	Experiments Recommended for Approval	Experiments Recommended for Conditional Approval	Totals
Experiments	180	4	184
Authors	1301	36	1337
Institutions	204	3	207
Countries	28		28

Approved Experiments Totals by Physics Topics

Topic	**Number Total**	**Hall A**	**Hall B**	**Hall C**
Nucleon and Meson Form Factors & Sum Rules	35	13	7	15
Few Body Nuclear Properties	28	17	6	5
Properties of Nuclei	34	12	11	11
N* and Meson Properties	60	13	37	10
Strange Quarks	27	7	16	4
TOTAL	184	62	77	45

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	44 0	813.9	20	301.0	2
B	61 9	713.8	19	296.0	6
C	34 5	769.0	10	304.8	2
Total	139 14	2296.7	49	901.8	10

APPENDIXES

A. PAC 33 Membership

B. Charge to PAC 33

C. PAC 33 Recommendations

D. PAC 33 Individual Proposal Reports

E. PAC 33 Individual Letters-of-Intent Reports

F. Approved Experiments, PAC 33, Grouped by Physics Category

(To access Appendix F, go to http://www.jlab.org/exp_prog/proposals/08prop.html

Appendix A
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Appendix B
Charge to PAC33

PAC 33 Charge:

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 traditionally two types of conditional approval: **C2** - conditional pending PAC review of open scientific questions; and **C1** - conditional pending Jefferson Lab management review of open technical issues. In the later case, the PAC should recommend a beam time allocation.

   For PAC33 only we have added a third type of conditional approval: **C3**†† – a modest impact experiment whose running is conditional on the availability of appropriate beamtime without impacting[22] planned running of the highest priority experiments)
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.

‡‡ If there are excellent proposals where the experiment does not fit into the highest priority list within the available beamtime (broadly – it would normally be "Deferred with Regret"), but the incremental technical requirements and installation needs are modest, consider giving it "C3". This is an experiment that should be run if it can be "fit in" to the experiment schedule without impacting planned running of the highest priority experiments (i.e. it uses beam conditions compatible with the planned running in the other halls, requires

minimal new equipment construction, and is not delaying installation and running of planned experiments in this hall)

APPENDIX C
PAC 33 Recommendations

A	PR-08-011		Polarized e-2H parity violating deep inelastic scattering (PVDIS) at CEBAF 6 GeV
A	PR-08-027		A Measurement of g2p and the Longitudinal-Transverse Spin Polarizability
A	PR-08-014		Three-nucleon short range correlations studies in inclusive scattering for $0.8<Q^2<2.8$ $(GeV/c)^2$
A	PR-08-007		Measurement of the Proton Elastic Form Factor Ratio at Low Q2
A	PR-08-005		Measurements of the Target Single-Spin Asymmetry Ay in the Quasi-Elastic 3He(e,e'n) Reaction
A	PR-08-025		Measurement of the Deeply Virtual Compton Scattering Cross-Section off the neutron
A	PR-08-010		Measurment of the Coulomb quadrupole amplitude in the $\gamma^*\Delta(1232)$ in the low momentum transfer region
C3	PR-08-008		Exclusive Study of Deuteron Electrodisintegration near Threshold
C3	PR-08-009		Detailed Study of 4He Nuclei through Response Function Separations at High Momentum transfers
C1	PR-08-021		Deeply Virtual Compton Scattering at 6 GeV with transversely polarized target using the CLAS Detector
A	PR-08-024		Deeply Virtual Compton Scattering off He4
A	PR-08-023		An Updated High Precision Measurement of the Neutral Pion Lifetime via the Primakoff Effect
C1	PR-08-015		Transverse spin effects in SIDIS at 6 GeV with transversely polarized target using the CLAS Detector
C3	PR-08-018		In-medium Properties of the rho, omega, and phi Mesons
C3	PR-08-003		The gamma $\gamma p \rightarrow \pi^+ n$ Single Charged Pion Photoproduction
A	PR-08-016		The Qweak Experiment:"A Search for New Physics at the TeV Scale via Measurement of the Proton's Weak Charge"
C3	PR-08-012		Study of Light Hypernuclei by Pionic Decay at JLab
C3	PR-08-002		Spectroscopic study of Lambda hypernuclei in the medium-heavy mass region and p-shell region using the (e,e'K+) reaction

- A=Accept,
- C1=Conditionally Approve w/Technical Review,
- C2=Conditionally Approve w/PAC Review,
- C3=Conditionally Approve
- D=Defer

APPENDIX D

Individual Proposal Report

Proposal: PR-08-001
Scientific Rating: N/A
Title: Investigation of the Role of Nuclear Medium Modifications in the ^{4}He(e(pol), e′ p(pol)) ^{3}H Reaction in Hall C

Spokespersons: E. Brash, R. Ransome, G. M. Huber, S. Strauch

Motivation: This proposal addresses the possibility of measuring modifications of intrinsic properties of the nucleon, in this case its elastic form factors, inside the nuclear medium. This may be achieved by measuring quasi-elastic electron scattering off a nucleus and detecting the recoiling proton. Both cross sections and polarization observables in this process will not only depend on the intrinsic nucleon form factors, but also on nuclear effects, in particular Final State Interactions (FSI) of the struck nucleon with the rest of the nucleus. Specifically, the induced polarization P_y in the quasi-elastic reaction ^{4}He(e(pol), e′ p(pol)) ^{3}H has been shown to be mainly sensitive to FSI. In turn, the ratio $P_x`/P_z`$ between the transverse and longitudinal transferred polarizations (a quantity proportional to the G_E/G_M ratio between electric and magnetic proton elastic form factors) may be sensitive to both in-medium modifications of the nucleon form factors and to nuclear effects. In recent measurements of the proton recoil polarization in this reaction at MAMI and Jefferson Lab, the measured $P_x`/P_z`$ ratio was found to differ from a fully relativistic calculation, favoring either the inclusion of a medium modification of the proton form factors predicted by a quark-meson coupling model, or strong charge-exchange final-state interactions. However, the measured induced polarization P_y is not consistent with the strong charge-exchange final-state interaction model, while it agrees well with the fully relativistic calculation. The proposal is therefore to perform a more precise measurement of $P_x`/P_z`$ and P_y as a function of Q^2 which would allow for a more careful comparison with the available theoretical models. The same measurement would be done on the deuteron, where nuclear effects are expected to be smaller. Since model calculations suggest that exploring the same observables as a function of the missing momentum would provide additional constraints, it is also proposed to perform a missing momentum scan at the lowest Q^2 points.

Measurement and Feasibility: The proposal is to measure the reactions ^{4}He(e(pol), e′p(pol))^{3}H and ^{2}H(e(pol), e′p(pol))n by scattering the JLab polarized electron beam off Helium and Deuteron targets. By measuring secondary scattering asymmetries in a Focal Plane Polarimeter (FPP), it is possible to extract the ratio $P_x`/P_z`$ between transferred polarizations and the induced polarization P_y. The experiment was deemed feasible and a few technical concerns on backgrounds and resolution were satisfactorily addressed. The experiment would involve substantial efforts to build and set up the new FPP and a new target, as well as to restore and calibrate the Short Orbit Spectromer (SOS).

Issues: The physics proposed is intriguing and this type of measurement provides a unique opportunity as to trying to pin down nuclear modifications, although model uncertainties may still make an uncontroversial conclusion not straightforward. The PAC would have liked to see this experiment done and regrets that there is no room for scheduling it in the remaining 6 GeV program.

Recommendation: Defer with regret

Individual Proposal Report

Proposal: PR-08-002

Scientific Rating: B+

Title: Spectroscopic study of Λ hypernuclei in the medium-heavy mass region and *p*-shell region using the (e,e'K+) reaction

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

Motivation: This is an extension of E05-115, which will be ready by the end of 2008. The proposal aims at determination of excited states of hypernuclei. The highlights of the proposed program include study of excited states in neutron-rich $^{7}He_{\Lambda}$ bound by the presence of Λ and determination of single-Λ states in medium-mass hypernuclei. The group has achieved a resolution of ~500 keV, a long term goal for the original hypernuclear program proposed as part of the original CEBAF program. The construction of a new high-resolution electron spectrometer (HES) is completed and the HES equipment is on its way to JLab.

Measurement and Feasibility: There are no outstanding technical problems compared to the approved E05-115 experiment. The request for beam time for additional calibration data is very reasonable.

Issues: The PAC was convinced that the study of excited states in $^{7}He_{\Lambda}$ has a high impact and should be pursued as soon as possible. It is also important to access the full systematics of single-Λ energies in the $7 \leq A \leq 52$ mass range. These measurements will nicely complement the studies approved in E05-115.

Recommendation: Conditionally approve: C3 in Hall C

Individual Proposal Report

Proposal: PR-08-003

Scientific Rating: B

Title: $\gamma p \rightarrow \pi^+ n$ single charged pion photoproduction

Spokespersons: D. Dutta, H. Gao and P.Rossi

Motivation: At large fixed scattering angle in the c.m. frame, there is a scaling law based on dimensional analysis that leads to counting rules that hold in pQCD. These are now backed by AdS/CFT considerations. These predict the differential cross-section for pion photoproduction will behave like s^{-7}. This is confirmed by existing data above 4 GeV in the c.m. However, at lower energies there is considerable oscillatory structure probably reflecting the appearance of overlapping resonances. The purpose of this proposed experiment is to map out the transition to scaling behavior in the energy region of 1.77 to 3.22 GeV.

In addition it will provide data, which when combined with results on the other two independent charge channels, $\gamma p \rightarrow \pi^0 p$ and $\gamma n \rightarrow \pi^- p$, are required for an isospin analysis of this process.

Measurement and Feasibility: The proposed experiment utilizes the standard equipment of Hall B and requires rates that are reasonable. No difficulties are foreseen.

Issues: Precision data have already been taken in the lower part of the proposed energy regime in the *g1c* running. The preliminary data presented by the current proposers show this maps out the region up to 2.5 GeV, which, when combined with the existing precision results on the other charge channels, should allow this region to be analyzed in terms of overlapping resonances with the GWU partial wave analysis program. For these studies the coverage of as large an angular range as is possible is required. The additional energy regime covered by this proposal marks only a small transition to the observed scaling at $\theta = 90^o$, for instance.

Recommendation: Conditionally approve: C3 for 3 days in Hall B.

Individual Proposal Report

Proposal: PR-08-005

Scientific Rating: B+

Title: Measurement of the Target Single-Spin Asymmetry, A_y, in the Quasi-Elastic $^3He\uparrow(e,e'n)$ Reaction

Spokespersons: T. Averett, D. W. Higenbotham, and V. A. Sulkosky

Motivation: Both polarized ^3He and polarized deuteron targets have been used to measure neutron form factors. Form-factor inconsistencies at low momentum transfer were resolved using the Faddeev calculations to describe ^3He. One indicator that the improved Faddeev calculations were valid was their ability to describe the large measured A_y in the $^3He\uparrow(e,e'n)$ at 0.2 GeV^2, which is zero in the impulse approximation. The proponents propose to extend the measurement of A_y to 0.75 and 1.0 GeV^2 in order to test Faddeev calculations at higher momentum transfer. Several theoretical groups with expertise in Faddeev calculations endorse the importance of the proposed measurements.

Measurement and Feasibility: The experimental team has considerable experience in performing experiments in Hall A. The target, beam, and spectrometers are well understood. The experimental team will install the Hall A Neutron Detector. The experiment will run parasitically with already scheduled experiments.

Issues: None

Recommendation: Approve to run parasitically with E05-015 in Hall A

Individual Proposal Report

Proposal: PR-08-006

Scientific Rating: N/A

Title: The Neutron Electric Form Factor at $Q^2 = 2.8$ and 4.3 $(GeV/c)^2$ from the Reaction $^2H(e,e'n)$ *via* Recoil Polarimetry

Spokespersons: R. Madey, S. Kowalski, A. Yu Semenov, B. D. Anderson, and B. Plaster

Motivation: The experiment is designed to extend measurements of the neutron electric form factor up to 4.3 GeV^2. A second point planned for 2.8 GeV^2 is intermediate between two of the recent Hall A E02-013 ^{3}He points. The neutron electric form factor is a fundamental quantity that has to be measured. A particular motivation is comparison of the electric isovector form factor data with lattice calulations. Also, in the region covered by this experiment the neutron electric form factor might exceed the proton electric form factor, leading to a negative isovector form factor. The results of the experiment will also allow a better extrapolation of experimental conditions for planned higher Q^2 measurements during the 12 GeV era.

Measurement and Feasibility: The experiment uses the established technique of quasi-free scattering of a polarized electron beam off a liquid deuterium target, with the outgoing neutron detected in the neutron polarimeter. Simulations of the experiment are based on the performance of the earlier E93-038 run. The use of the deuteron target is complementary to the use of polarized ^{3}He targets.

Issues: This is a major installation experiment that cannot be approved now due to a lack of available beam time before the 12 GeV upgrade. The PAC is concerned that this 6 GeV proposal provides only a small improvement in the knowledge of G_E^n over the expected results of the E02-013 polarized ^{3}He experiment, particularly given the range of Q^2 that can be covered after the 12 GeV upgrade. The PAC encourages the collaboration to continue developments since it is important to cover the broadest possible range of Q^2 after the 12 GeV upgrade.

Recommendation: Defer with regret.

Individual Proposal Report

Proposal: PR-08-007
Scientific Rating: A-
Title: Measurement of the Proton Elastic Form Factor Ratio at Low Q^2
Spokesperson: J. Arrington, D. Day, R. Gilman, D. Higinbotham, G. Ron, A. Sarty

Motivation: It is proposed to perform a high precision measurement of the proton electromagnetic form factor ratio $\mu_p G_E/G_M$ in the Q^2-range between 0.015 and 0.70 GeV^2. Two different (independent) methods will be used: (i) the double spin asymmetry (DSA) technique for $Q^2 = 0.015 – 0.40$ GeV^2 (the low-Q^2 range), and (ii) the recoil-polarization technique for $Q^2 = 0.25 – 0.70$ GeV^2 (the high-Q^2 range). At low Q^2, a precise measurement of the form factors would allow a more precise determination of the Zemach radius of the proton and reduce the systematic uncertainty from roughly 2-3% to 1% in experiments sensitive to the low-Q^2 form factors, in particular parity violating experiments on the proton. Tests of the theoretical understanding of the proton hyperfine structure are limited by the present accuracy of the Zemach radius. In the higher Q^2 range, the aim of the experiment is to investigate possible structure in the form factors determined from previous experiments, and moreover provide precise data to constrain the parameterizations and models used to describe the form factors in this Q^2 range. In particular, this possible structure has been proposed as evidence for the virtual pion cloud of the nucleon. This measurement should be able to confirm or to refute this structure at the level of a few percent.

Measurement and Feasibility: The proposal describes essentially two independent experiments that will both be conducted in Hall A: To measure the DSA, longitudinally polarized electrons impinge on a polarized solid NH_3-target with polarization axis at 20°; elastically scattered electrons are determined simultaneously in the two HRS spectrometers. The recoil-measurement will exploit the polarization transfer from longitudinally polarized electrons to a proton polarization in the scattering plane, measured using a HRS with focal plane polarimeter. Eleven days are requested for the DSA measurement, and 14 days for the polarization transfer measurement. The latter could be reduced to 12 days if the lowest Q-point would not be taken.

Issues: The high Q^2 part of the proposal had been conditionally approved by PAC31 subject to further PAC review, with the condition to compare the projected outcome to a similar experiment which has recently been completed at MAMI. This PAC is now convinced that it is worthwhile to improve over the expected accuracy of the Mainz-result by factors between 2 and 5 in the form factor ratio with the well-tested setup from the LEDEX experiment. Because of the strong transverse components of the holding field of the polarized target, the DSA measurement requires a major setup effort including the development of a beam line reconfiguration with chicane. The PAC was not convinced that the large effort necessary to run this experiment (alone) was sufficiently justified, since there is doubt that the measurement would be able to distinguish between most of the different calculations, given that the ratio must approach unity for Q^2 approaching zero. However, it was appreciated that the setup for this experiment, in particular the beam line reconfiguration, was the same as that for a different experiment (PR-08-027), which was approved with an A- rating for 24 days. In the event that it is possible to mount PR-08-027 and the schedule/budget will allow the additional beam time, the PAC granted conditional approval (C3) to the DSA measurement.

Recommendation: Recoil Polarization measurement: Accept for 14 days in Hall A
Double Spin Asymmetry Measurement: Conditionally approve: C3

Individual Proposal Report

Proposal: PR-08-008

Scientific Rating: B+

Title: Exclusive Study of Deuteron Electrodisintegration near Threshold

Spokespersons: B. Norum, W. Bertozzi, S. Gilad, and K. Wang

Motivation: The experiment is designed to provide a detailed investigation of threshold deuteron electrodisintegration at $Q^2 = 12$ fm^{-2}. Inclusive d(e,e') measurements at these momentum transfers, summed over $E_{np} \sim 0$ - 3 MeV, were among the first compelling data for isovector meson exchange currents; without these exchange currents the cross section would vanish at this momentum transfer, from interference between the S and D wave components of the deuteron wave function. A large but non-comprehensive set of low energy and momentum transfer photodisintegration and electrodisintegration measurements exist. Cross sections are generally well predicted by theory, but there are some problems with polarization observables and response functions. Data in this region will help constrain the meson exchange currents and improve our knowledge of deuteron structure.

Measurement and Feasibility: The experiment measures exclusive d(e,e'p)n, in kinematics with E_{np} up to several MeV. The scattered electron is detected in HRS, and the ejected proton is detected in the Bigbite spectrometer. Resolution is high, so the data can be binned in E_{np}. The exclusive measurement provides separations of the L, T, LT, TT, and LT' response functions. The LT and TT separations are done through the azimuthal distributions of recoil protons about the momentum transfer *q* direction. The L and T response functions are separated with two different ε points. The LT' response function is extracted from the beam helicity dependent azimuthal distribution of recoil protons.

Issues:
The motivation for the experiment is solid. The PAC remains concerned about potential backgrounds in BigBite, which will not be experimentally tested until the upcoming spring 2008 experiments in Hall A. There is insufficient beam time available in Hall A to fully approve this experiment.

Recommendation: Conditionally approve: C3 in Hall A

Individual Proposal Report

Scientific Rating: B+

Proposal: PR-08-009

Title: Detailed Study of ^{4}He Nuclei through Response Function Separations at High Momentum Transfers

Spokespersons: K. Aniol, F. Benmokhtar, S. Gilad, D.W. Higinbotham, A. Saha

Motivation: It is proposed to study the structure of ^{4}He as well as the reaction dynamics of the (e,e′p) process by measuring most of the unpolarized response functions at a Q^2 that matches a previous experimental study (performed by the same collaboration) of the same reaction on ^{3}He. It is hoped that sophisticated theoretical predictions of this reaction in these light nuclei, in which a microscopic many-body treatment of the nuclear structure is possible, would lead to a precise understanding of the role of final-state interactions in the reaction. Such precision would provide a stronger basis for interpreting (e,e′p) studies in other experiments.

Measurement and Feasibility: The experiment uses standard Hall A spectrometers and a cryogenic target; it could be run as soon as time is made available.

Issues: The general goals of very high accuracy measurements do not appear to be well justified given the variation in theoretical model predictions presented. However, the PAC recognizes that these data will serve as a benchmark for the foreseeable future. No technical issues with the experiment were identified. Due to the very tight constraints on available beam time in Hall A before the 12 GeV upgrade, the experiment could only be granted conditional approval.

Recommendation: Conditionally approve: C3

Individual Proposal Report

Proposal: PR-08-010

Scientific Rating: B+

Title: Measurement of the Coulomb quadrupole amplitude in the $\gamma^*\Delta(1232)$ in the low momentum transfer region

Spokespersons: N. Sparveris, S. Gilad, R. Higinbotham and A. Sarty

Motivation: In a classic paper on the quark model in the context of QCD, Isgur, Karl and Koniuk discussed D-waves in the ground state baryons as a test of color magnetic interactions. These cannot be observed in the static properties of the proton, but would be reflected in electric and Coulomb quadrupole components in the predominantly magnetic dipole transition of a nucleon to the $\Delta(1232)$ induced by the absorption of a virtual photon. The size of these effects were computed in the constituent quark model, for instance by Capstick and Karl. Measurements at Bates and MAMI of the longitudinal-transverse cross-section, σ_{LT}, have found effects that correspond to a Coulomb quadrupole amplitude that is much larger than this quark model prediction. It has been suggested that this is because the constituent quark picture takes no account of the chiral nature of pion interactions-that in addition to a quark core in each baryon there is a pion cloud, which generates components in the ground state baryons that are P-wave, as a consequence of the axial vector coupling of the Goldstone pions. These components would contribute more significantly to the quadrupole moments, as modeled for instance by Sato and Lee. These effects are expected to be particularly important at small values of Q^2, when the photon probes the longer wavelengths where the pion cloud "sits". The aim of this experiment is map out the dominant magnetic dipole amplitude with precision, determine the quadrupole amplitude as a function of Q^2, including the lowest values at which these effects have been measured. A precise determination of the parallel cross-section through the region of the $\Delta(1232)$ should resolve discrepancies between existing datasets. The proposed experiment will with 3.5 days of running add to the global knowledge of the transition amplitudes, and constrain the phenomenological modeling of the pion cloud. It should motivate progress to be made in lattice calculations, which like the constituent quark models, do not yet include chiral pions. It will be interesting to see how these calculations evolve as the mass of the light quarks moves towards their physical values and see whether these reproduce the measured quadrupole amplitudes. The beam time request is commensurate with the physics goals.

Measurement and Feasibility: The quantities CMR and EMR have been measured at Bates and MAMI. The proposed experiment will resolve discrepancies between these data. The techniques for performing the measurements and analyzing the data are well developed. The group has considerable experience in this type of experiment. The experiment uses standard spectrometers and targets. The likelihood of success is high.

Issues: None

Recommendation: Approve for 4 days in Hall A

Individual Proposal Report

Proposal: PR-08-011

Scientific Rating: A-

Title: $\vec{e} - {}^{2}H$ Parity-Violating Deep-Inelastic Scattering (PVDIS) at CEBAF 6 GeV

Spokespersons: X.-C. Zheng, R. Michaels and P. E. Reimer

Motivation: The experimental team proposes to measure parity-violating longitudinal asymmetries from ^{2}H in deep-inelastic kinematics. The asymmetries are very large by PV standards (100 times larger than Qweak). The results will determine the combination of weak quark couplings $2C_{2u}$-C_{2d}. Charge-symmetry violation (CSV) and higher-twist (HT) effects can modify the PV asymmetries. The proponents estimate the CSV effect in two models and find that the modification of the asymmetry is 10 times smaller than the goal statistical error and can be neglected. For very large Q^2, higher-twist effects are $\sim 1/Q^2$. The team proposes to measure asymmetries at Q^2 = 1.1 and 1.9 GeV^2. If the PV asymmetries are found to be $\sim Q^2$, the PV asymmetries can be combined to determine the quark coupling. The quark coupling is poorly known; the experimental goal is to reduce the uncertainty by a factor of 7.

The same team proposed to extend this work to 12 GeV, first with the base-line 12 GeV spectrometers (PR12-07-102) and perhaps in a second round of 12 GeV experiments, with a dedicated large-acceptance spectrometer. In order to access the potential of PVDIS, it is necessary to begin the program in order to map out and understand phenomenologically HT and CSV effects. (CSV is very interesting in its own right.) The results from this pioneering proposal may begin a very exciting program of study that will extend into the 12 GeV era.

Measurement and Feasibility: The experimental team has many seasoned investigators. The target, beam, and spectrometers are well understood. The risk is minimal.

Issues: none

Recommendation: Approve for 32 days in Hall A

Individual Proposal Report

Proposal: PR-08-012

Scientific Rating: A-

Title: Study of Light Hypernuclei by Pionic Decay at JLab

Spokespersons: L. Tang, A. Margaryan, L. Yuan, S.N. Nakamura, J. Reinhold

Motivation: This proposal, complementary to the approved experiment E05-115, describes a potential program of novel systematic studies of light hypernuclei at JLab using pionic decay. The project aims at determination of structural properties, such as binding energies, lifetimes, production mechanism, and in-medium effects on electric and magnetic properties of hypernuclei. The highlights of the proposed program include (i) high precision measurements of binding energies of hypernuclei (55 keV resolution; to be compared with current resolution ~500 keV); (ii) Studies of exotic, extremely rich halo hypernuclei such as ${}^{6}H_{\Lambda}$; (iii) Measurements of electromagnetic rates (and moments) using a "tagged-weak π-method"; (iv) Studies of production of neutron-rich hypernuclei by means of multifragmentation. This program has a potential to move JLab into the field of precision hypernuclear spectroscopy that is essential for making an impact on modern shell-model and ab-initio calculations of hypernuclei. To this end, the group intends to use the recently developed high-resolution kaon spectrometer (HKS) for tagging strangeness production and use the existing Enge spectrometer as a high-resolution magnetic spectrometer for pions from hypernuclear decay (HπS).

Measurement and Feasibility: This is a large installation experiment, requiring installation of the HKS spectrometer, the Enge spectrometer and a splitter magnet. The incoming beam would be re-chicaned by using the beamline designed and built for E05-115, changing the incline angle from 14 degrees to 8.2 degrees. The experiment would use two targets, ${}^{7}Li$ and ${}^{12}C$. According to the TAC report, there are a number of experimental issues with rates, precision in pion momentum, background, and Li target. However, all these comments were addressed by the proponents.

Issues: The PAC was convinced that this is an outstanding experiment with very high impact that should be pursued. Nevertheless, for the success of this new program it is important to demonstrate that the proposed measurements can be performed without major issues. The PAC believes that a test study of the production mechanism, following the completion of PR-08-002, is necessary. For the test, the use of the HES spectrometer instead of the Enge spectrometer is suggested.

Recommendation: Conditionally approve: C3 for 5 days in Hall C, if a meaningful test is feasible.

Individual Proposal Report

Proposal: PR-08-013

Scientific Rating: N/A

Title: Precision Measurement of the Neutron Form Factor up to 8.0 $(GeV/c)^2$ by the Ratio Method

Spokesperson: B. Quinn, B. Wojtsekhowski

Motivation:
This proposal intends to perform a high-precision measurement of the neutron magnetic form factor for Q^2 = 3.5, 4.5, 5.25, 6.0, 7.0, and 8.0 $(GeV/c)^2$. The measurement will improve the data base, in particular above 5 $(GeV/c)^2$ by using the "ratio-method", resulting in a reduction of both statistical and systematic errors.

Measurement and Feasibility:
The experiment will be conducted in Hall A, using three beam energies (4, 5, and 6 GeV). G_M^n is deduced from the ratio of n-and p-coincident cross sections for quasi-elastic scattering from the deuteron that are measured simultaneously. Scattered electrons will be detected with the BigBite spectrometer, equipped with a new gas Cherenkov detector. The nucleons (proton, neutron) will be identified with BigHAND, sitting 17 m away from the target to allow for time-of-flight measurements. In between a large aperture dipole magnet for deflecting the protons onto a spot different from the neutrons will be implemented. This is a large installation experiment where understanding the acceptance and efficiency of the BigHAND is essential. The proposal thoroughly discusses several simulation studies and specific calibration measurements that may be used to guarantee that this is successfully achieved.

Issues:
The proposed experiment will complement the data which will soon come out from a CLAS measurement, covering the Q^2-range up to 4.8 $(GeV/c)^2$. There is also an accepted proposal to measure G_M^n at higher Q^2, using CLAS12, although this will have to wait for the completion of the accelerator and detector upgrade. The PAC thus considers the proposed measurement a very valuable intermediate step to provide early data in addition to the exploratory SLAC results beyond 4.8 $(GeV/c)^2$. The PAC would have liked to see this experiment performed and regrets that there will be no time left for scheduling it in the remaining 6 GeV program.

Recommendation: Defer with regret

Individual Proposal Report

Proposal: PR-08-014

Scientific Rating: A-

Title: Three-nucleon short range correlations studies in inclusive scattering for $0.8 < Q^2 < 2.8$ $(GeV/c)^2$

Spokespersons: P. Solvignon, J. Arrington, D. Higinbotham, D.B. Day

Motivation: A simple model of the contributions of correlations to inclusive electron scattering from nuclei has been used to predict local scaling of the cross sections for correlated clusters of nucleons. The scaling is seen as plateaus in the ratios of cross sections for heavy and light nuclei as functions of Bjorken x and Q^2. Earlier studies at SLAC and JLab demonstrated the scaling for $1.5<x<2$, i.e., in the region of two-nucleon short-range correlations (2N SRC). A recent paper by Egiyan et al., PRL 96, 082501 (2006) suggests an existence of the second plateau at $2.25<x<2.8$, attributed to three-nucleon (3N) SRC. Independently, in two-nucleon knock-out reaction studies, the dominance of correlated np pairs over pp pairs in the range of relative momenta (275–550) MeV/c has been demonstrated and explained in terms of deuteron-correlations due to the tensor force. The proposed study has several objectives: (i) Confirm the existence of the second plateau in *both* x *and* Q^2; (ii) Extract relative contributions of 2N and 3N SRC; (iii) By using ^{40}Ca and ^{48}Ca targets, study the isospin dependence of 2N and 3N SRC; and (iv) Study the cross section ratios with respect to ^{4}He thus providing first insight into 4N SRC. The measurement is complementary to the two-nucleon knockout measurement E07-006 and will provide guidance for the approved 12 GeV measurement E12-06-105 that will address physics at at $x>3$.

Measurement and Feasibility: The experiment is a straightforward application of the HRS and beamline base equipment. Five production targets will be used: ^{2}H, ^{3}He, ^{4}He, ^{12}C, ^{40}Ca, and ^{48}Ca. It is a high impact experiment which will stimulate theoretical developments in this area.

Issues: The PAC was convinced that this is an outstanding experiment which should be pursued as soon as possible.

Recommendation: Approve for 12 days in Hall A.

Individual Proposal Report

Proposal: PR-08-015

Scientific Rating: A-

Title: Transverse spin effects in SIDIS at 6 GeV with transversely polarized target using the CLAS Detector

Spokespersons: H. Avakian, P. Bosted, K. Hafidi, N. Makins and P. Rossi

Motivation: The proposal describes a study of spin azimuthal asymmetries in semi-inclusive DIS using 6 GeV polarized electron beam, a transversely polarized HD-Ice target and the CEBAF Large Angle Spectrometer (CLAS). Transverse target single-spin asymmetries (TTSA) and transverse spin-dependent double-spin asymmetries (TDSA) will be measured *via* semi-inclusive pion production in the e-p interaction, in the region of hard-scattering kinematics. The protons will be transversely polarized while the electrons will carry a longitudinal polarization (TDSA) or no polarization (TTSA). The x, z and p_T dependencies of the TTSA will be studied over a wide range of kinematics. They will provide an access to the Sivers function (leading twist), describing the transverse motion of the quarks in a transversely polarized nucleon, the transversity function describing the transverse polarization of quarks in a transversely polarized nucleon, and the "pretzelosity" describing the transverse momentum distribution of transversely polarized quarks in a transversely polarized nucleon. Also a significant extension of the (x, Q^2) range of the g_2 measurements for the proton and the deuteron will be achieved, decreasing the systematic error in CLAS EG4 (and other experiments') extraction of g_1. This is the first low energy (high x) measurement from a transversely polarized target, which will substantially improve the statistical uncertainties of HERMES on the proton and bridge to the low x COMPASS results on the deuteron and (in the future) on the proton.

Measurement and Feasibility: The proponents request 45 days in Hall B/CLAS; out of these 30 days were to be run in parallel to experiment PR-08-021. Only the standard configuration of CLAS will be involved. The proposed measurements seem to be feasible as shown by the analysis of already existing electroproduction results from CLAS. The HD-Ice target is the only nonstandard critical element of the setup. At this time, it is not known how the target will perform when an electron beam passes through the target material.

Issues: The transverse momentum dependent (TMD) parton distributions are an important albeit missing part of the nucleon spin structure. They provide information on the spin-orbit correlations in the nucleon. Some of them are only accessed through the transversely polarized target.

The study of TMDs was the central motivation for the construction of CLAS12. However, such measurements bring with them a variety of complications that take significant time (years) to understand and to develop a global analysis framework. For that reason, it is essential that preparations be made to ensure that new results emerge

from the upgraded detector in a timely fashion. The proposed running at 6 GeV will permit the collaboration to use the two years of the shutdown to get a handle on the complex aspects of such experiments. The most important of these is the HD-Ice target; while it brings a huge enhancement to the FOM for such experiments, it is certainly one of the complications and the proposed measurement of asymmetries can provide information vital to optimizing its performance for 12 GeV running.

The PAC believes that the difficult question of the correctness of the (low energy) factorization assumption, which is fundamental to the TMD measurements, can only be addressed by acquiring new experimental data. The proposed measurement at 6 GeV may be helpful in this respect.

Finally, the PAC stresses that even about half of the proposed experimental program (the one with an unpolarized beam) may provide crucial and important information on the TMDs. However, the extremely limited beam time allocations force the PAC to only approve running parasitically with PR-08-021, for only 25 days.

Recommendation: Conditional approval: C1, conditional on the successful tests of the HD-Ice target in beam conditions, parasitically with PR-08-021 in Hall B.

Individual Proposal Report

Proposal: PR-08-016

Scientific Rating: A

Title: The Q_{Weak} Experiment: A Search for New Physics at the TeV scale *via* a Measurement of the Proton's Weak Charge

Spokespersons: R. D. Carlini, J. M. Finn, R. Kowalski, S. A. Page

Motivation: This is an update of a highly rated approved experiment which aims to measure the parity violating asymmetry in polarized e-p elastic scattering. It requests 198 days of running in Hall C with 85% beam polarization and 1.165 GeV beam energy. The experiment would measure the very small predicted asymmetry to ±4% and within the Standard Model framework determine the value of $\sin^2\theta_W$ to about ±0.3% (±0.0007), *i.e.* about a factor of two better than the previous best low energy experiments. Comparison of that measurement with high energy precision Z-pole results from CERN and SLAC provides a probe of new physics (beyond the Standard Model) at a mass scale of several TeV. At that level, such a study complements the LHC and will help confirm or constrain possible discoveries of Z' bosons, technicolor, large extra dimensions, super symmetry *etc*.

Measurement and Feasibility: The Q_{Weak} experiment will be one of the flagship experiments at JLab. It will take full advantage of the superb polarized electron beam now available and will be a world class effort. The effort will also pave the way for a future polarized electron scattering program at 12GeV where novel forefront experiments such as high precision polarized electron-electron elastic scattering (Moller) become possible.

Issues: The PAC enthusiastically approves the Q_{Weak} experiment and its running time request. The PAC encourages the Laboratory to make every effort possible to attain the running goals of P08-016. However, if severe budgetary difficulties occur, running to reach at least a ±5% asymmetry measurement should be made a very high priority. Falling below this level would severely compromise the goals of the experiment. The PAC also suggests that the Q_{Weak} experiment run (longer) at a beam current of 150 μA rather than 180 μA.

Recommendation: Approve for 198 days in Hall C

Individual Proposal Report

Proposal: PR-08-017

Scientific Rating: N/A

Title: Polarization Transfer in Wide Angle Compton Scattering

Spokespersons: B. Wojtsekhowski, A. Nathan, R. Gilman, D.J. Hamilton

Motivation: The experiment's goal is a measurement of three spin-dependent observables, K_{LL}, K_{LS}, and P_N, in Real Compton Scattering (RCS) off protons at wide angles. The measurements are planned at two kinematic points with $s = 9$ GeV^2 and $-t = 3.6$ and 4.9 GeV^2. The principal motivation behind the experiment is that the RCS reaction at values of s, $|t|$, and $|u|$ significantly larger than the nucleon mass squared is dominated by the "handbag diagram" and so can be described within the framework of the Generalized Parton Distributions (GPDs). In the GPD framework, each of the RCS response functions $R_V(t)$, $R_A(t)$, and $R_T(t)$ is sensitive to the $1/x$-weighted integral over one of the GPDs (summed over flavor). The measurement of the spin-transfer observables K_{LL} and K_{LS}, when combined with the existing RCS cross-section measurements from experiment E99-114, would permit the independent determination of the three RCS response functions at the two requested kinematic points.

Measurement and Feasibility: The proposed experiment was deemed feasible, but constitutes a significant undertaking in Hall A: the requested 21 days of running would be preceded by a month of installation work.

Issues: This proposal is a resubmission of the Hall A part of PR-07-002. PAC31 approved the Hall C part of this proposal, which requires 3 days of running and provides K_{LL}, K_{LS}, and P_N at one kinematic point: $s = 9$ GeV^2 and $-t = 2.4$ GeV^2. The two higher-t points proposed again here for Hall A were deferred as the physics motivation was not believed to be strong enough to warrant the needed resources. As described in the PAC31 report, the applicability of the GPD formalism to wide-angle RCS is on weak theoretical footing, most notably due to the absence of a proven factorization theorem for this process. This situation has not changed. In the proposal's response to PAC31, a new calculation is cited which suggests that the "pQCD" mechanism's inability to account for even the sign of the K_{LL} as measured by E99-114 might be due to the rather low $|u|$ value of that measurement. However, of the three kinematic points proposed in PR-07-002, the already-approved Hall C point is at the highest $|u|$ value of the three.

Recommendation: Defer

Individual Proposal Report

Proposal: PR-08-018

Scientific Rating: B+

Title: In-medium Properties of the rho, omega, and phi mesons

Spokespersons: D. Weygand, M. H. Wood, C. Djalali, and R. Nasseripour

Motivation: There has been great interest in possible modifications of the properties of mesons (and baryons) in the nuclear medium. Results for the mass and width of the ρ meson from several experiments at several laboratories are contradictory; some experiments use hadronic entrance or decay channels which are subject to large initial or final state interactions, or sensitive primarily to the more diffuse nuclear surface. To minimize complications from hadronic interactions, a CLAS g7a measurement used an incoming tagged photon beam and detected outgoing e^+e^- pairs of the ρ decay. The experiment found the medium modification, measured by a parameter α expected to be 0.16±0.06 according to some models, was 0.02±0.02, entirely consistent with no modification. This new proposal has a different choice of targets and a luminosity five times greater. The improved statistics will allow testing predictions that medium modifications are ρ-momentum dependent, greater at lower ρ momentum, in addition to improving the overall uncertainty.

Measurement and Feasibility: The experiment uses the same configuration already shown to work in the g7a experiments. The integrated luminosity increase comes from a longer beam time (x2) and increased instantaneous luminosity (x2.5), which is not expected to be a problem.

Issues:
The PAC is convinced of the validity of the existing results, that the vector mesons are produced and decay mostly inside the nucleus, and that no significant mass shift is seen. Measuring the rho-momentum dependence of any possible effect is important. It is also important that the t-dependence of the data be examined, to remove any contributions from diffractive production. The increased statistics will allow a quantitative study of this problem. The PAC is concerned about whether the physics is optimized by using both Fe and Nb targets, as opposed to focusing on more improved statistics only with the Fe target. The PAC recommends using only Fe, not Fe plus Nb targets.

Recommendation: Conditionally approve: C3 for 28 days in Hall B

Individual Proposal Report

Proposal: PR-08-019

Scientific Rating: N/A

Title: Measurements of the Deuteron, Proton and He-3 Magnetic Form Factors at Large Momentum Transfers

Spokespersons: A. Camsonne, J. Gomez, A. Katramatou, N. Sparveris and G. Petratos

Motivation: This experiment is designed to measure the deuteron elastic magnetic structure function $B(Q^2)$ at up to Q^2=6 GeV^2, the magnetic form factor of the proton $G_M^p(Q^2)$ for 0.4 GeV^2 < Q^2 < 4.3 GeV^2, and the magnetic form factor of ^{3}He in the region of the first zero and for Q^2 = 75 fm^{-2}. Previous experiments for elastic electron-deuteron scattering at Jefferson Lab have measured $A(Q^2)$ up to Q^2=6 GeV^2 while $B(Q^2)$ was measured for Q^2 < 1.5 GeV^2. Data for $B(Q^2)$ from SLAC are available up to about 3 GeV^2 but with relatively large errors. These data suggest that there is a minimum at about 2 GeV^2. This minimum is due to interference between s- and d-wave contributions and its position has been shown to be very model dependent. As a result, while many models can adequately describe $A(Q^2)$ and $T_{20}(Q^2)$ they show a considerable variation in $B(Q^2)$. Precision data for $B(Q^2)$ for the range covered by this experiment are essential to constrain the theory of the deuteron at large Q^2.

The same equipment allows for a direct measurement of G^n_M with much of the data obtained simultaneously with $B(Q^2)$. A measurement of F_M for ^{3}He can also be obtained.

Measurement and Feasibility: This experiment requires a major installation in Hall A consisting of two new electron spectrometers at large angles, a double septum magnet at the pivot point of the HRS and movement of the target upstream. The experiment is otherwise feasible.

Issues: It would have been useful if the presentation had included a more detailed discussion of the relevance of these data in understanding of the nature of the nucleus in terms of QCD. In particular, how would these data relate to lattice QCD? The PAC also notes that, given the large installation and relatively large beam time request, it would have been helpful if the proponents had presented reduced beam time options in the proposal for the PAC to evaluate.

Recommendation: Defer with regret

Individual Proposal Report

Proposal: PR-08-020

Scientific Rating: N/A

Title: Exploring Very High Missing Momenta in Deuteron Electro-Disintegration

Spokespersons: W.U. Boeglin, D.W. Higinbotham

Motivation: This experiment would measure the d(e,e'p) cross section for $Q^2 = 3.5$ GeV^2 and $x_{Bj}=1.3$ for missing momenta 0.5 GeV $\leq p_m \leq$ 1 GeV. These kinematics minimize the contribution of final state interactions and should provide information about non-nucleonic degrees of freedom at large missing momenta.

Measurement and Feasibility: The measurement requires a fixed beam energy of 5.25 GeV and a fixed scattering angle of 24.13 degrees for $Q^2=3.5$ GeV^2 and $x_{Bj}=1.3$. Standard Hall A equipment is used and the experiment poses no special difficulties.

Issues: .The PAC was concerned about the interpretability of these data given the current state of theory and encourages that work be done on this issue.

Recommendation: Defer with regret

Individual Proposal Report

Scientific Rating: A

Proposal: PR-08-021

Title: Deeply Virtual Compton Scattering at 6 GeV with transversely polarized target using the CLAS Detector

Spokespersons: H. Avakian, V.D. Burkert, M. Guidal, R. Kaiser, F. Sabatié

Motivation: It is proposed to measure single and double azimuthal spin asymmetries of the DVCS process from transversely polarized hydrogen and deuterium. The ultimate goal is to contribute towards the precise determination of the generalized parton distributions (GPD) that encode the complete three-dimensional structure of the nucleon. Transverse target azimuthal asymmetries (TTSA) are very sensitive to the GPD E function, the contribution of which is kinematically suppressed in DVCS asymmetries from longitudinally polarized beams and/or targets. The GPD E is a critical part of the Ji angular momentum sum rule. The double spin azimuthal asymmetries (TDSA) would allow the determination of the real part of both the H and E Compton form factors more precisely.

Measurement and Feasibility: The collaboration proposes to use a 1-2 nA rastered electron beam impinging on a frozen HD-ice target. The CLAS spectrometer would detect the scattered electron in coincidence with the final state proton, allowing reconstruction of the missing mass of the real photon; in 30% of events, the photon would also be detected. The feasibility of this technique to identify DVCS events in CLAS is well established. Simulations have been used to optimize the location of the target within the constraints of the beamline and mini-torus magnet. The HD-ice target is very attractive for transverse polarization due to the relatively weak holding field (of order 100 gauss); also the dilution factor is quite small. Assuming that the required target polarization can be maintained over reasonable timescales, the experiment appears feasible.

Issues: The BNL target and its technical staff are in the process of being moved to Jefferson Lab, and considerable effort and funding will be required to set up the HD-ice target on site. The principle question regarding feasibility is whether the electron beam significantly degrades the lifetime of the target polarization; in previous experiments, only real photon beams have been used. The first planned use of the target at Jefferson Lab would be for the tagged real photon experiment (in CLAS) E06-101. Study of possible electron beam effects on the target should be performed just after the completion of E06-101 in order to determine the feasibility of PR-08-021. Regarding the measurements themselves, the PAC encourages the collaboration to attempt to measure absolute spin-dependent cross sections, rather than asymmetries, in order to facilitate the planned (Fourier) amplitude decomposition. However, due to the tight constraints on beam time available in Hall B before the 12 GeV upgrade, the PAC is only able to approve 25 of the 30 requested days.

Recommendation: Conditionally approve: C1, conditional on the successful tests of the HD-Ice target in beam conditions, for 25 days in Hall B

Individual Proposal Report

Proposal: PR-08-022
Scientific Rating: N/A
Title: Semi-Inclusive Spin Asymmetries on the Nucleon Experiment ("Semi-SANE")
Spokespersons: X. Jiang, M.K. Jones, D. Day

Motivation: This experiment aims to collect semi-inclusive pion and kaon production data in the deep inelastic scattering regime from polarized hydrogen and deuterium targets. The primary physics interest in these data is their sensitivity to the flavor-separated quark helicity distributions $\Delta q(x)$ in the nucleon. The data will be collected at rather modest values of W (between 2 and 3 GeV) where the applicability of the pure current-quark fragmentation ansatz is likely not exact. The experiment will explore this very question. To address its impact on the extraction $\Delta q(x)$ from the data, a variety of analysis techniques will be employed, each relying on a somewhat different set of assumptions about models for the SIDIS production mechanism. In accord with the exploratory nature of these intermediate-energy data, the proposal does not include any estimates of the eventual systematic uncertainty on $\Delta q(x)$: one must clearly have the data in hand before such can be reliably determined.

Measurement and Feasibility: PAC26 approved this experiment, E-04-113, for 25 days. PAC 31 subsequently approved E07-011 for only 8 days since it could share16 days with Semi-SANE. Now in this update Semi-SANE is requesting 28 days, 17 of which are fully parasitic with the approved experiment E07-011 which will measure the inclusive structure function g_1 on the deuteron. Semi-SANE would simply use the otherwise-idle HMS spectrometer to measure final state mesons during data taking. The other 11 days are requested for dedicated Semi-SANE running from a hydrogen target (polarized NH_3). These data would be collected immediately after the SANE experiment, which will use the same target and experimental configuration, but requires the HMS spectrometer for calibration purposes. Semi-SANE thus poses no particular technical challenges.

Issues: Although it is clear that the measurement of $\Delta q(x)$ from SIDIS data is better suited to 12 GeV running, the PAC supports the collection of polarized SIDIS data in the $2 < W < 3$ GeV region at 6 GeV: "precocious scaling" of the fragmentation process may well extend to lower W than presently expected, and if so, that is interesting in its own right. However, given the constraints on the remaining beam time available at 6 GeV, the PAC finds that the semi-inclusive data which can be collected during the 17 days of parasitic running with E07-011 (from the deuterium target) are sufficient to address questions of SIDIS factorization and to provide valuable new data on Δq at high x. The PAC stresses that its "defer" recommendation is based entirely on the assumption that E07-011 will run, and that Semi-SANE will use the HMS as planned to collect SIDIS data from deuterium at the same time. The PAC urges the Laboratory to retain the beam time allocation for E07-011 that had formerly been parasitic to Semi-SANE despite the difficult decision to defer Semi-SANE to stay within the PAC allocation.

Recommendation: Defer

Individual Proposal Report

Proposal: PR-08-023

Scientific Rating: A-

Title: An updated High Precision Measurement of the Neutral Pion Lifetime *via* the Primakoff Effect

Spokespersons: A. Gasparian, R. Miskimen, M. Ito, L. Gan

Motivation: This proposal requests an additional run of 28 days in Hall B. Its goal is to carry out a precise measurement of the $\pi^\circ \rightarrow \gamma\gamma$ decay width via the Primakoff effect, $\gamma N \rightarrow \pi^\circ N$, using a forward electromagnetic spectrometer with good mass resolution, which allows for pion discrimination at the low Q^2 Primakoff peak. It would employ two targets ^{12}C and ^{208}Pb and take high statistics with each target.

The $\Gamma(\pi^\circ \rightarrow \gamma\gamma)$ width results from the chiral anomaly and is very precisely predicted, $\Gamma(\pi^\circ \rightarrow \gamma\gamma)$=8.1eV with a small ±1% uncertainty. Its value is a cornerstone of QCD. Verification provides an important test of the theory and confronts a longstanding direct lifetime measurement at CERN which found $\Gamma(\pi^\circ \rightarrow \gamma\gamma)$=7.25±0.23 eV, about a 3.5 sigma deviation from theory. Validating QCD at about the ±1.4% level and confronting the CERN result represent the main goals of PR08-023.

Measurement and Feasibility: In the first run, this experiment found the preliminary result, $\Gamma(\pi^\circ \rightarrow \gamma\gamma)$=7.93eV, with errors of ±2.1% (statistical) and 2.0% (systematic). This result is in agreement with QCD but the overall error is about the same as the old CERN result and is, therefore, not definitive. In a proposed second run, the proponents aim to increase the statistics by an order of magnitude and use them to help reduce the systematic errors. Their goal is a final overall error of ±1.4%, which is well matched to the ±1% theory error and capable of providing a lasting standard.

Issues: The PAC was concerned about the dominance of systematic errors in this proposal and their dependence on a large background subtraction and theoretical modeling. It would be useful to have separate results for the two nuclear species, as a consistency check. Also, since the final numerical result for the width is so crucial for this experiment, an unbiased procedure such as a "blind analysis" would be useful for providing confidence in the result. The proponents should seriously consider the viability of such an approach.

Recommendation: Approve for 20 days in Hall B

Individual Proposal Report

Proposal: PR-08-024

Scientific Rating: A-

Title: Deeply Virtual Compton Scattering off ^{4}He

Spokespersons: K. Hafidi, F.-X. Girod, E. Voutier, H. Egiyan, S. Liuti

Motivation: This experiment will measure the beam-helicity asymmetry A_{LU} for Deeply Virtual Compton Scattering (DVCS) from hydrogen and ^{4}He targets. It is established that the DVCS process at the kinematics of the proposed measurement can be well described by the handbag diagram and the GPD description of nucleon structure. The proposed experiment will explore the GPDs in a nuclear context, with an unprecedented statistical precision that will permit two-dimensional kinematic binning in x and t. Both coherent and incoherent DVCS from ^{4}He will be measured and the two processes will be cleanly separated *via* recoil detection with the BONuS detector. Mapping the GPDs allows one to learn about the transverse spatial distribution of quarks within the target. With coherent and incoherent nuclear-DVCS data in hand, important new information can be gleaned about the origin of the EMC effect and the exact nature of the medium modification of bound nucleons. The choice of ^{4}He as the nucleus to study is well motivated: due to its zero spin its (coherent) structure is described by a single GPD.

Measurement and Feasibility: The proposed experiment uses the CLAS detector in a configuration which has been successfully employed before. The only new element is the upgrade of the BONuS readout controllers. It is a straightforward upgrade which involves installing the now-available ALICE readout cards for which the detector was originally designed. The 45 days of requested beam time are entirely parasitic with approved experiment E07-009 which will use the same detector configuration and targets.

Issues: None

Recommendation: Approve for 45 days of concurrent running with E07-009 in Hall B

Individual Proposal Report

Proposal: PR-08-025

Scientific Rating: B^+

Title: Measurement of the Deeply Virtual Compton Scattering off the Neutron

Spokespersons: M. Mazouz, C.E. Hyde, A. Camsonne

Motivation: This proposal is aimed at measuring the unpolarized DVCS cross section off the deuteron in quasifree kinematics at $Q^2 = 1.9$ GeV^2 and $x_B = 0.36$. As a by product the experiment would also measure the neutral pion production. The neutron and coherent deuteron DVCS cross section would be obtained by subtracting the proton cross section measured in E07-007. Two beam energies are requested in order to separate the DVCS^2-term and the interference term (of DVCS and Bethe-Heitler) as well as to separate the longitudinal and transverse pion electroproduction cross sections.

Measurement and Feasibility: The experiment will be conducted in Hall A at 4.82 and 6.0 GeV. With a beamtime of 17 days, the experiment will obtain a systematic accuracy of ~5%.The experimental technique is: (i) use of a deuteron target, (ii) detection of the scattered electron in a magnetic spectrometer, and (iii) the emitted photon in an electromagnetic calorimeter, with the reaction being identified via missing mass. In order to deduce the neutron-DVCS part, a number of corrections/subtractions have to be applied: both the setup and the analysis procedure has been tested in a precursor experiment (E03-106, which has been published in PRL in 2007). It is expected that the proposed measurement will lead to much improved results due to the experience gained leading to a number of improvements for the setup. It will be essential to run this experiment together with an approved p-DVCS experiment (E07-007).

Issues: While the PAC considers it very important to obtain n-DVCS data, some concerns were raised about the intrinsic smallness of the interference term for the neutron. Although it is the most interesting part of the cross section because it is a linear combination of GPDs, it may be difficult to extract using the energy dependence. However since the neutron is the only source of information on this particular flavor combination of GPDs there is no alternative and therefore the PAC recommends that the experiment should be performed.

Recommendation: Approve for 17 days in Hall A

Individual Proposal Report

Proposal: PR-08-027

Scientific Rating: A-

Title: A Measurement of g_2^p and the Longitudinal – Transverse Spin Polarizability

Spokespersons: A. Camsonne, J.-P. Chen and K. Slifer

Motivation: The experiment measures the inclusive spin-structure function $g_2(x)$ on the proton in the resonance region, for $0.04 < Q^2 < 0.2$ GeV^2. This function remains unmeasured for $Q^2 < 1.3$ GeV^2. Combined with the CLAS EG4 data on g_1^p in the same Q^2 range, the data will permit extraction of the generalized polarizability δ_{LT}^p on the proton and and allow comparisons with the Chiral Perturbative Theory (χPT) calculations. This quantity is of major interest since *e.g.* the NLO χPT results for the neutron γ_0^n agree with data at $Q^2 = 0.1$ GeV^2 but fail at reproducing the δ_{LT}^n there ("δ_{LT}" puzzle). The data will also permit a test of the Burkhardt-Cottingham sum rule for the proton in this unexplored Q^2 range, a determination of the extended GDH sum rule and assist in reducing systematic errors on the EG4 $g_1^p(x)$ measurements.

Measurement and Feasibility: The proposed experiment constitutes a major installation in Hall A requiring significant resources. However, none are felt to be insurmountable, and no particular technical obstacles were identified.

Issues: This proposal is an update to the conditionally approved experiment E07-001. It addresses the request of the PAC31 to strengthen the physics case for $Q^2 > 0.1$ GeV^2 portion of the proposed run. The proposal addresses all the three issues raised by PAC31, *i.e.*:

i) the projected results for the Burkhardt-Cottingham sum rule and d_2^p are both displayed and carefully discussed;
ii) the impact of the data on the systematic error of g_1^p extracted by CLAS EG4 is quantified;
iii) the impact of the data on the ongoing calculations of the hyperfine structure of hydrogen is discussed.

The PAC finds those additions satisfactory and concludes that the requested running time and resources are justified.

Recommendation: Approve for 24 days in Hall A

APPENDIX E

Individual Proposal Report

Proposal: LOI-08-004

Scientific Rating: TBD

Title: First Search for ϕ-N Bound State

Spokespersons: Yi Qiang, Haiyan Gao

Motivation: Since the ϕ is primarily an s s bar bound state it is expected that the ϕN interaction should be dominated by an attractive color van der Waals force. This suggests that there may be molecular bound states of this system. Models have indeed indicated that this may be the case. This letter of intent proposes that these bound states could be detected by sub-threshold photoproduction of the ϕ on protons in nuclei. A simple model indicates that such a bound state could then be detected through decay into kaons.

Measurement and Feasibility:

Issues: Recent observations of similar charmed molecular states at electron-positron colliders indicate that this may be a very interesting experiment. It has long been thought that the scalar mesons, a_0, $f_0(980)$, may well be molecular in nature with hidden strangeness. Clear observations in recent years of several possibly molecular states with hidden charm have strengthened this idea. It is then natural to study whether baryons with such hidden strangeness exist and serve to motivate this proposal. However, one possible concern is the effect of the interaction of such a molecular state with other nucleons in a nucleus. It would be very useful if the theory could be further developed before a submission of a full proposal to a future PAC.

Recommendation: The PAC recommends that this letter of intent be developed into a proposal to be presented to a future PAC.

APPENDIX F

Jefferson Lab Experiments, PAC 32,
Grouped by Category

(To access Appendix F, go to http://www.jlab.org/exp_prog/proposals/08prop.html