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Report of the
January 31- February 2, 2001
Meeting of the

Jefferson Lab
Program Advisory Committee

PAC 19

February 25, 2001

Members of the Jefferson Lab User Group,

Jefferson Lab and its User community have reached the point where our physics productivity has become evident and a steady stream of quality publications is forthcoming. It is of the utmost importance that we maintain this momentum and let the world, in a scientific and a wider sense, know about our findings and their impact. We are pushing the machine, equipment, and staff within limited resources to deliver the best physics possible, with high polarization and beams in excess of 5 GeV. We have already delivered 50% of the approved program, with 30 experiments complete and data for portions of 47 more in three years of full operation. Sixty-eight PhD's have been awarded based on JLab research with another 156 PhD students currently pursuing thesis projects in JLab research. We would love to run longer and with better efficiency than our constrained budget allows, and will continue to mount our best effort possible within our boundary conditions to deliver beams of the quality and characteristics required by our users for our experimental program.

The laboratory's performance has been recognized via our peer review process, where we achieved a rating of Outstanding in both the Science and Technology and Institutional Management Peer Reviews. The challenge as we move forward is to continue to stretch ourselves and to acquire the operations funding needed to maintain the level of excellence and productivity that our customers have come to expect.

Continuing our program based on a large number of approved and excellent proposals, we also look to the future needs of our field in pursuing the 12 GeV upgrade. The user community has been very active in working through the white paper process, and now the White Paper describing the compelling science case at 12 GeV is out in the community. The same holds true with regard to the Town Meeting White Paper summarizing the conclusions of the Dec. 1-4, '99, meeting on Hadronic Physics where the 12 GeV Upgrade was identified as the first priority in our field. It is rewarding to see the culmination of years of activity in our user community, including several workshops to explore and pursue the science that an energy upgrade allows. The lab and our users are working together tirelessly in preparation for the NSAC Long-Range Planning process and we hope that our users will continue to be active with their colleagues in our and other fields to gain acknowledgement of the value of this science and support for the upgrade.

We continue to advance our core competencies and their application in a broader context. Our detector technology has spawned a spin-off in the field of medical imaging that has been reviewed by experts in the field who rate it as a program with world-class potential. We are successfully contributing to the construction effort of the SNS, today's largest project in the Office of Science. The FEL continues to act as a valuable test bed for the development of forefront accelerator physics and technology. Of particular importance is the demonstrated operation in energy recovering mode, which is essential to high luminosity electron-ion collider concepts. In some version of these concepts an energy recovering linac is used to provide the high-energy electron beam for collier operation.

We are making progress in both our Basic and Applied programs with the Free Electron Laser, with a recent workshop on "Scientific Frontiers with Accelerator-Based Lasers" finalizing its report.

I would like to thank PAC 19 and its chair, Don Geesaman for their efforts reviewing and making recommendations regarding additions to our experimental program and their judicious use of the jeopardy process. We share their deep concern that we are sacrificing valuable physics for lack of more operating time. Their thoughtful consideration and guidance is critical to the continued excellence of our program. I would particularly like to thank Don Geesaman who is rotating off the PAC after years of dedicated service. He has been an active proponent of JLab and its science and we appreciate his hard work and enthusiasm.

Sincerely,

Christoph Leemann
Interim Director

Report of the January 31- February 2, 2001 Meeting of the Jefferson Lab Program Advisory Committee (PAC19)

Introduction

The Jefferson Lab Program Advisory Committee held its 19th meeting on January 31- February 2, 2001. The membership of the Program Advisory Committee is given in Appendix A. In response to the charge (Appendix B) from the interim director, Dr. Christoph Leemann, the committee reviewed and made recommendations on sixteen new proposals and four letters of intent.

The PAC would like to acknowledge the efforts of the laboratory staff in support of the PAC meeting, especially those of Shauna Cannella.

General Overview

The PAC noted that the experimental program continues to proceed well. The number of weeks of beam delivered to experiments, combining the accelerator performance and the Hall multiplicity, exceeds the goals of the laboratory. The publication stream from the experimental program is strong. We are particularly impressed with the attention that has been paid to the offline computing capability and delighted to note that it was judged to be sufficient for the current experiments.

The PAC advises the laboratory to give higher emphasis to concerted studies of the systematic parameters that determine the ultimate precision of the JLab experiments. Significant progress has been made in understanding the energy, polarization and angle calibrations in individual halls, but much remains to be done. Rosenbluth separations are a major component of the laboratory's research and the precision and reliability of these measurements are often dominated by these factors. Too frequently, time scheduled for such studies is forfeited to make up for problems in running experiments. The laboratory should take the lead in ensuring that these systematic measurements are completed satisfactorily and that the results are broadly circulated to the user community. It is likely that completed experiments can use the new knowledge to correct their results.

The PAC and the laboratory have specifically asked proponents of new proposals to clearly state how their experimental goals are addressed by other approved experiments at the laboratory. Spokespersons are not paying sufficient attention to this charge, which can result in the PAC not considering a new proposal until the information is provided. Users must also remember that the current PAC members do not have easy access to past proposals. If you submit an update, either make it self-contained or make sure that each PAC member receives a copy of the original proposal.

Recommendations

The laboratory guidelines provided for the approval of 124 days of beam time in Hall A, 30 days of beam time in Hall B and 89 days of beam time in Hall C. These guidelines were established based on 30 days of new time to be available in each Hall plus 50% of the time from approved experiments required to return to the PAC due to the jeopardy process. This PAC completed the first pass at jeopardy proposals in Hall A. Due to the large number of such proposals they were spread over PAC 18 and 19. Two Hall A proposals, one Hall B proposal and four Hall C proposals under jeopardy were considered at this meeting. The PAC is allowed to exceed the laboratory guidelines if it believes the physics has sufficiently high priority, at the level of an A- rating or better, but the excess is then deducted from the allocation of the next PAC meeting. The high demand for beam time in Hall A at this meeting made the task of the PAC extremely difficult and it was necessary to defer experiments that the PAC would like to see done. The PAC approved six experiments in Hall A for a total of 122 days, one experiment in Hall B for 6 additional days of beam time and four experiments in Hall C for a total of 72 days.

The reports and PAC recommendations for the reviewed proposals and the letters-of-intent are given in Appendices D and E. The tables on the following pages summarize the results from PAC 4-19.

With the conclusion of the deliberations of this PAC, I am stepping down as chair of the Program Advisory Committee. I would like to thank the laboratory, the users, and most especially my fellow PAC members for their devotion to the exciting scientific opportunities at JLab. It is a privilege to be a part of such a dynamic community. I eagerly await the outstanding results that I know will continue to emerge.

Donald Geesaman
Chair, Jefferson Lab Program Advisory Committee

APPENDICES

A. PAC19 Membership

B. Charge to PAC19

C. PAC19 Recommendations

D. PAC19 Individual Proposal Reports

E. PAC19 Letters-of-Intent

* Approved Experiments, PACs 4–19, Grouped by Physics Category
(To access Appendix F, go to http://www.JLab.org/exp_prog/PACpage/)

Totals for PAC 4-19

	Experiments Recommended for Approval	Experiments Recommended for Conditional Approval	Totals
Experiments	121	10	131
Authors	859	40	899
Institutions	148	5	153
Countries	26		26

Approved Experiments Totals by Physics Topics

Topic	**Number**	**Hall A**	**Hall B**	**Hall C**
Nucleon and Meson Form Factors & Sum Rules	17	7	3	7
Few Body Nuclear Properties	22	12	6	4
Properties of Nuclei	24	6	10	8
N* and Meson Properties	40	6	27	7
Strange Quarks	18	4	11	3
TOTAL	121	35	57	29

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	15 / 2x .5 1x .25 1x.13	329.1	10.62	428.8	4
B	3 / 4x .70 2x .8 3x .76 4x.72 23x.5 6x.61	284.4	27.27	256.63	5
C	14 / 2x .5 1x .25	293.5	10.25	236	1
Total	32 / ~27.35	907.00	48.14	921.43	10

Appendix A

PAC 19 Membership

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Appendix B

Charge to PAC19

Jefferson Lab requests that PAC19:

1) Review both new proposals* and extensions† or updates ᵛ 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 science issues,
   * Deferral, or
   * Rejection.

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.

*Beginning with PAC15, previously-approved proposals that have not run within 3 years of approval or 3 years after the start of physics in the relevant hall (whichever is later) 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 and original proposal are considered only to the extent that they may bear on the relevance merit of the extension proposal.

ᵛ 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

PAC19 Recommendations

Class*/Grade/Days

A/A$^-$/10	E-01-001	New measurement of G_E/G_M for the proton.
A/B$^+$/25	E-01-002	Baryon Resonance Electroproduction at High Momentum Transfers.
D	PR-01-003	Measurement of Strange Quark Effects using Parity-Violating Electron Scattering from ^{4}He at $Q^2 = 0.6$ $(GeV/c)^2$.
A/ A$^-$/14	E-01-004	The Charged Pion Form Factor.
D	PR-01-005	Measurement of the Weak Pion Nucleon Coupling Constant h^1_π from Backward Pion Photoproduction near Threshold on the Proton.
A/B$^+$/14	E-01-006	Precision Measurement of the Nuclear Spin Structure Functions in the Region of the Nucleon Resonances.
C/A$^-$/30	E-01-020:	
	PR-00-007 and PR-00-008	Short-distance Structure of the Deuteron and Reaction, Dynamics in ^{2}H(e,e'p)n and A Study of the Dynamics of the Exclusive Electro-disintegration of the Deuteron.
R	PR-00-009	Search for K$^-$ Mass Modification in the Nuclear Medium with Sub-threshold ^{12}C(e,e'K$^{+/-}$) Processes.
	PR-00-010	Withdrawn.
A/A$^-$/19	E-01-011	Spectroscopic Study of Lambda Hypernuclei up to the Medium-Heavy Mass Region Using the (e,e'K$^+$) Reaction.
A/B$^+$/17	E-01-012	Measurement of Neutron (^{3}He) Spin Structure Function in the Resonance Region.
D	PR-01-013	Testing the Limits of the Full Relativistic $(\dot{e}, e'\dot{p})$ Reaction Model.
A/ B$^+$/16	E-01-014	Precision Measurement of Electroproduction of π^0 near Threshold: A Test of Chiral QCD Dynamics.
C/B$^+$/23	E-01-015	Studying the Internal Small Distance Structure of Nuclei via the Triple Coincidence (e,e'pN) Measurement.
A/A$^-$/26	E-01-016	Precision Measurement of Longitudinal and Transverse Response Functions of Quasi-Elastic Electron Scattering in the Momentum Transfer Range 0.55 GeV/c < q < 1.0 GeV/c.
A/A$^-$/6	E-01-017	Meson Spectroscopy in Few-Body Decays.

* A=Approve, C=Conditionally Approve, D=Defer, R=Reject

Individual Proposal Report

Proposal: E-01-001

Scientific Rating: A^-

Title: New measurement of G_E/G_M for the proton.

Spokesperson: R. E. Segel and J. Arrington

Motivation: The disagreement between the Rosenbluth method and the polarization transfer method of existing determinations of G_E/G_M motivates this experiment to make a new Rosenbluth measurement with several improvements to the experimental method. It is of great importance to determine if there is a fundamental problem with either the Rosenbluth or polarization transfer methods, as they are also used for many other experiments.

Measurement and Feasibility: The new measurement will detect protons, which have fixed momentum at fixed Q^2, independent of epsilon. By simultaneously making measurements at very low Q^2, where there is no controversy, systematic errors are reduced compared to the previous Rosenbluth measurements, which detected electrons over a wide range of momentum at fixed Q^2, and did not have a simultaneous low Q^2 measurement. Radiative corrections are also smaller using protons. The experiment uses standard equipment and methods, and appears to be straightforward to carry out.

Issues: The PAC believes it would be of higher scientific value to emphasize more precise measurements at the lower values of Q^2 , where the Rosenbluth method and polarization transfer already have a significant difference. It will be very important to check the assumed linearity of the Rosenbluth separation with respect to epsilon at the optimal Q^2 values by taking data at more epsilon points than proposed.

Recommendation: Approve for 10 days in Hall A.

Individual Proposal Report

Proposal: E-01-002

Scientific Rating: B^+

Title: Baryon Resonance Electroproduction at High Momentum Transfers

Spokespersons: V. Frolov, J. Price and P. Stoler

Motivation: This is an update of proposal E-97-101. The study of excitation of the $\Delta(1232)$ and $S_{11}(1535)$ resonances would be extended to momentum transfers of Q^2=7.5 GeV^2 by measuring the kinematically complete reactions $^1H(e,e'p)\pi^0$, η . The aim is to examine the transition between low and high momentum transfer physics. Generalized parton distributions provide a new tool to connect the extracted form factors to other exclusive reactions.

Measurement and Feasibility: The requested beam energy is 5.75 GeV, at 90 μA, with protons detected in the HMS and electrons in the SOS. The exact values of energies and luminosity are not crucial.

Issues: The systematic errors will be slightly larger than for the original experiment. The increased model dependence at higher values of Q^2 complicates the extraction of the resonance multipole amplitudes.

Recommendation: Approve for 25 days in Hall C.

Individual Proposal Report

Proposal PR-01-003

Scientific Rating: NA

Title: Measurement of Strange Quark Effects using Parity-Violating Electron Scattering from ^{4}He at $Q^2 = 0.6$ (GeV/c)^2 -- Update to E91-004

Spokesperson: E. J. Beise

Motivation: This is an update of proposal E-91-004. The experiment would measure the parity violating asymmetry in elastic electron scattering from ^{4}He at $Q^2 = 0.6$ (GeV/c)^2, corresponding to the first maximum of the charge form factor. In the one-body limit, this asymmetry gives a direct measure of the strange electric form factor of the proton, G_E^s, with entirely different uncertainties than for comparable measurements on hydrogen. Experiments to date carried out on the proton and on deuterium are sensitive to linear combinations of the strange electric, magnetic and axial form factors, and all have yielded results that are consistent with very small or zero strange quark contributions. The possibility of a clean measurement of G_E^s at higher Q^2, where a number of calculations predict that a significantly nonzero result might be obtained, is very attractive.

Measurements and Feasibility: When it was originally proposed, this experiment faced a number of technical challenges associated with the need for high current polarized beam and the development of a high power ^{4}He target. These have largely been addressed by recent developments, although further work on the target is still required. The asymmetry in the absence of strange quark contributions is 50 ppm; experimental systematic errors, expected to be at the 10^{-8} level, are not an issue. At the proposed counting rates, using a 100 microAmp beam and a 15 Atm He gas target, the experiment would require 65 days of beam in hall A.

Issues: A low Q^2 measurement on ^{4}He is approved for running in Hall A (E-00-114). The G0 experiment will measure both G_E^s and G_M^s from parity violating electron scattering on the proton to comparable accuracy at a range of Q^2 that brackets the value proposed here, but with very different sources of uncertainty. The low Q^2 ^{4}He experiment can be viewed as an independent check on the G0 measurement of G_E^s, since nuclear medium effects are expected to be very small at low Q^2. The proponents of PR-01-003 have presented the case for this higher Q^2 measurement in order to determine G_E^s to +/-0.06 with a theoretical uncertainty of +/- 0.02. The PAC notes that the choice of Q^2 near the minimum of the impulse approximation contribution to the form factor may further cloud the interpretation of this experiment in terms of G_E^s, and suggests that it would be highly desirable to update the theoretical calculations in light of new constraints on strange quark contributions to parity violation from SAMPLE and other experiments.

The PAC believes that this higher Q^2 measurement of the ^{4}He strange form factor is of great interest in its own right, but that nuclear medium effects such as meson exchange currents may

make the interpretation in terms of the proton strange electric form factor less clear than stated in the proposal. New information from approved and in-progress experiments, together with additional work on the theoretical interpretation, could further strengthen the case for running this experiment in the future.

Recommendation: Defer.

Individual Proposal Report

Proposal: E-01-004

Scientific Rating: A^-

Title: The Charged Pion Form Factor

Spokespersons: G. M. Huber, D. Mack and H. Blok

Motivation: This is an update to the extension of E-93-021. Determination of $F_\pi(Q^2)$ over an extended range in Q^2 provides a challenging test of QCD models of hadron structure. Pion electroproduction from hydrogen and deuterium is currently the favored approach for extracting $F_\pi(Q^2)$ for Q^2>0.5 GeV^2.

Measurement and Feasibility: Recent results from JLab have yielded high quality data, which have been used to extract $F_\pi(Q^2)$ up to Q^2=1.6 GeV^2. The experiment involves measuring the differential cross-sections for $^1H(e,e'\pi^+)n$ and $^2H(e,e'\pi^{+/-})NN$ at two values of the photon polarization, for each Q^2. The JLab measurements were carried out at W=1.95 GeV. Extraction of $F_\pi(Q^2)$ is a model-dependent procedure.

The present proposal would extend the data on $F_\pi(Q^2)$ to higher Q^2. Data would be taken at Q^2=1.6, 2.0, and 2.5 GeV^2 at W=2.2 GeV. The lowest Q^2 point repeats the earlier measurement but at a higher W. Measurements at higher W are preferred since they correspond to a smaller value of |t|, providing a more reliable extrapolation to the π^+ pole and thereby reducing the model dependence of the extracted $F_\pi(Q^2)$.

Issues: The PAC believes the measurement at Q^2=2.0 GeV^2 does not significantly add to the physics and recommends that measurements be taken only at Q^2=1.6 and 2.5 GeV^2.

Recommendation: Approve for 14 days in Hall C.

Individual Proposal Report

Proposal: PR-01-005

Scientific Rating: N/A

Title: Measurement of the Weak Pion Nucleon Coupling Constant h^1_π
from Backward Pion Photoproduction near Threshold on the Proton.

Spokesperson: Riad Suleiman

Motivation: The goal is to measure the weak pion-nucleon coupling constant. This is clearly an important quantity and the proposed reaction of threshold pion photoproduction allows for a reasonably clean interpretation. The proposed technique is complementary to measurements in nuclei, which have yielded conflicting results, and to planned measurements in the NN system.

Measurement and Feasibility: The proposed measurement technique is to detect pions, in an integrating detector, from photoproduction near threshold, using a polarized beam and unpolarized hydrogen target. The goal is to measure the parity violating asymmetry with statistical and systematic errors below 5×10^{-8}, a very ambitious goal. There is no directly comparable experiment that has demonstrated that such small systematic errors can be obtained with this experimental technique.

Issues: The measurement is a fundamental and important one. Given the large impact on lab resources that it would have, it is important to demonstrate that a measurement with a combined statistical and systematic error of 5×10^{-8} or less on the asymmetry can be made in a reasonable amount of running time, such as the proposed 45 days. While dedicated running time will be needed to address some of the difficult background issues in this experiment, it is felt that a much higher level of confidence in the experiment would be inspired by more refined and detailed calculations of backgrounds and systematic errors, combined with some low-impact parasitic beam tests when polarized beams are in use. Questions that need to be answered include:

a) How can the helicity asymmetry measured by the integrating detector be verified? Considerable attention needs to be paid to the development of:

- i) an appropriate current mode detector. The ionization chamber will suffer from spallation noise due to reactions in entrance windows, which will affect the accuracy of the measurement.
- ii) a null test for this detector.
- iii) an experimental verification of the fraction of the detector current that comes from the pions of interest.
- iv) a calibration measurement of the parity violating asymmetry – is there a known parity violating asymmetry that can provide such a test?

b) How big are helicity correlated backgrounds from particles interacting with iron in the sweep magnet that deflect electrons to the dump? Many low energy electrons and all of the positrons produced in the radiator will not make it to the dump.

Recommendation: Defer.

Individual Proposal Report

Proposal: E-01-006

Scientific Rating: B^+

Title: Precision Measurement of the Nuclear Spin Structure Functions in the Region of the Nucleon Resonances.

Spokesperson: O. A. Rondon

Motivation: This is an update of proposal E-96-002. It is proposed to measure the spin structure functions of the proton and the deuteron, at Q^2=1.3 GeV^2, and A_{TT} for the proton at Q^2=5.5 GeV^2, in the resonance region with high precision and resolution. These precision measurements are useful for a test of local duality for the spin structure functions.

Measurement and Feasibility: At Q^2=1.3 GeV^2, the nucleon spin asymmetries A_1 and A_2 are extracted from measurements of asymmetries for target spin orientation parallel ($A_{//}$) and perpendicular (A) to the beam helicity. The separate determination of these two asymmetries, in a region where A_2 is not negligible, yields the spin structure functions g_1 and g_2. While there is significant overlap with two ongoing Hall B experiments, E-91-023 and E-93-009, this proposal offers the advantage of a complementary measurement of $A_?$. The collaboration has considerable experience with the techniques involved.

Issues: The motivation for the proposed measurement of A_{TT} (~A_1) at Q^2=5.5 GeV^2 is not perceived as compelling. For the measurement at Q^2=1.3 GeV^2, the PAC recommends that more scientific emphasis be put on the A configuration, for a better determination of g_2.

Recommendation: Approve for 14 days in Hall C.

Individual Proposal Report

Proposal: E-01-020: proposed as PR-01-007 and PR-01-008

Scientific Rating: A^-

Title: Short-distance Structure of the Deuteron and Reaction Dynamics in $^2H(e,e'p)n$ and A Study of the Dynamics of the Exclusive Electro-disintegration of the Deuteron.

Spokespersons: P. Ulmer, J. Mitchell and M. Jones; W. Boeglin, A. Klein and E. Voutier

Motivation:
PR-01-007: This is an update of proposal E-94-004. The $^2H(e,e'p)n$ cross section would be measured on both sides of the quasi-elastic peak using parallel/antiparallel kinematics in order to minimize the effects of final-state interactions and enhance the influence of short-range nuclear structure. In addition the R_{LT} structure function would be extracted in perpendicular kinematics at three values of Q^2. That structure function is known to be especially sensitive to relativistic effects. Deuteron short-range structure and relativistic effects are the focus of this proposal.

PR-01-008: The measurement of the angular distribution of the recoiling neutron in exclusive two-body electrodisintegration of the deuteron at high missing momentum (p_m) is expected to provide a quantitative understanding of final state interactions, meson exchange currents and isobaric currents at large p_m.

Measurement and Feasibility:
PR-01-007: Measurements would be performed in Hall A using a 4 GeV unpolarized electron beam and the pair of high-resolution spectrometers. Liquid deuterium and hydrogen (for purpose of calibration) targets would be employed. Electron scattering angles of 12.5^o, 22.0^o and 35.0^o were chosen, corresponding to Q^2 values around 0.7, 1.8 and 3.25 GeV^2/c^2. A total of 19 days of beam was requested. A short (3 day) feasibility run at Q^2=0.66 GeV^2/c^2 was made in 1999.

PR-01-008: The proposed experiment intends to study the quasi-elastic electrodisintegration of the deuteron via the $^2H(e,e'p)n$ reaction and to measure the differential cross section. The complete angular distribution of the recoiling neutron with respect to the virtual photon, which is very sensitive to final state interactions, will be measured at three p_m values (0.2, 0.4 and 0.5 GeV/c) and three Q^2 values (1.0, 2.5 and 4.0 GeV^2/c^2). To accomplish this experimental program a beam of 100 μA will scatter on a 15 cm liquid deuterium target; scattered electrons and protons will be detected in the two HRS spectrometers in Hall A. The counting rates were estimated using recent calculations based on the Glauber approximation or on a diagrammatic approach. Proton and electron singles rates are within the spectrometer capabilities and signal-to-noise ratio is generally large. A total of 21 days was requested.

Issues: The PAC considers that the knowledge of the high momentum components of the deuteron wave function is fundamental to the understanding of the N-N structure at short distances. For that purpose a good understanding of FSI, MEC, IC, and relativistic effects is required. The extraction of the R_{LT} structure function could give significant new information on relativistic effects in the deuteron. The PAC is convinced that the settings of PR-01-007 and PR-01-008 could be redefined in order to achieve the physics goals of both proposals with a total beam time of less than the total of both proposals.

Recommendation: Conditionally approve for 30 days in Hall A. The PAC recommends 30 days of beam time for the combined experiments, conditional on formation of a unified collaboration and submission to the laboratory of a coherent run plan that achieves the key physics goals of both experiments. The combined experiment is given the number E-01-020.

Individual Proposal Report

Proposal: PR-01-009

Scientific Rating: N/A

Title: Search for K^- Mass Modification in the Nuclear Medium with Sub-threshold $^{12}C(e,e'K^{+/-})$ Processes.

Spokespersons: D. Dutta, F. Dohrmann and H. Gao

Motivation: The prime goal of the experiment is to find evidence for a shift in the effective mass of the K^- inside nuclei. The experimenters also want to use sub-threshold production as a probe of short range correlations.

Measurements and Feasibility: Electroproduction of K^+ and K^- from liquid hydrogen and solid carbon targets at the same kaon energies for virtual photon energies above and below their free particle threshold energies will be studied in Hall A. Kinematics are chosen such that the observed kaons will have momenta of 0.3-0.4 GeV/c, and the ratio of K^- to K^+ events will be determined, both above and below free particle threshold. The proposed signature of a mass modification would be an increase in the super-ratio, which is defined as the ratio of the below-threshold to the above-threshold ratios, significantly above unity. Final state interaction effects are supposed to cancel in the super-ratio. Kaons will be detected in the Enge split pole magnet. It must be mounted in the hall, and the standard beam line and scattering chamber setup must be modified. Singles rates are high, and backgrounds are not well known.

Issues: Although it was recognized that the subject of medium modification of the K^- mass in nuclei is of current interest, particularly in the heavy ion community, the PAC felt that the interpretation of many experiments in this area was not compelling. The proposed electroproduction experiment, although likely cleaner than the experiments with hadrons, suffers from similar problems in interpretation. One basic issue is that it is not possible to completely separate the effects of FSI from medium modifications, since the final state interactions are just the interactions that would be responsible for the possible mass modification. In addition, the super-ratio technique presumes a simple factorization model for eliminating the effects of FSI, and neglects the different character of the production process above and below threshold, particularly for the K^-. Interpretation of the results would require understanding of the production mechanisms that are not known, especially for K^-. In addition, a careful systematic study of e.g., the dependence of the effect on the mass of the target and on the momentum of the kaons, would be necessary to interpret the results. It is difficult to see how this could be done, given the low counting rates.

Recommendation: Reject.

Individual Proposal Report

Proposal: E-01-011

Scientific Rating: A^-

Title: Spectroscopic Study of Lambda Hypernuclei up to the Medium-Heavy Mass Region Using the $(e,e'K^+)$ Reaction.

Spokesperson: O. Hashimoto, L. Tang and J. Reinhold

Motivation: The physics of Λ -Hypernuclei has generated broad interest over the past three decades. In the strong interaction sector, the investigation of the Λ - nucleus shell model potential, determination of the Λ N spin-orbit splitting, and the Λ N spin-spin interaction are limited by the missing mass resolution and poor statistics hitherto available at hadron facilities. The proposed Hall C facility has a goal of 300 keV resolution and would have major impact on the investigation of these exotic systems.

Measurement and Feasibility: It is proposed to study the $(e,e'K^+)$ reaction on medium mass targets with a new kaon spectrometer, the HKS, and the Enge split pole magnet as the electron spectrometer. The major technical considerations are a) resolution and calibration of the new HKS spectrometer, b) management of the backgrounds and singles rates in the two spectrometers in order to achieve acceptable signal to accidental coincidence rates, and c) demonstrating that the promised 300 keV mass resolution can be achieved with targets of appropriate thickness, consistent with acceptable hypernuclear production rates. Preliminary studies of these issues are very encouraging.

Issues: Several technical issues are critical to the success of this project.
a) Can the HKS acceptance be shielded from the forward electron pair production?
b) Is the technique of tilting the Enge Split Pole magnet angle adequate for the required reduction in background from bremsstrahlung-induced events?
c) Can the pion rejection in the detector package, trigger logic, and accidental coincidence rate performance be made compatible with 30 μA electron beam operation?

The PAC concludes that the physics potential of this new facility in the investigation of these exotic hypernuclear systems is outstanding. Nevertheless this is a major construction project for Hall C. We recommend that

a. JLAB management organize a technical review of the project in order to evaluate the performance of the two-armed spectrometer system, the infrastructure required to support this facility, and the project management, MOU's etc. needed to assure a successful project.
b. After commissioning of the facility, that 19 days of beam time be allocated for the purpose of spectroscopic measurements in ^{12}C and one other target.

Recommendation: Approve for 19 Days in Hall C.

Individual Proposal Report

Proposal: E-01-012

Scientific Rating: B^+

Title: Measurement of Neutron (^{3}He) Spin Structure Function in the Resonance Region.

Spokesperson: J. P. Chen, N. Liyanage and S. Choi

Motivation: A precise extraction of g_1^n and A_1^n in the resonance region, using a polarized ^{3}He target, will investigate quark-hadron duality for the spin structure functions.

Measurement and Feasibility: The proposed experiment intends to perform a precise measurement of the neutron spin structure function g_1^n with almost complete W coverage of the resonance region for $1.0<Q^2<5.4$ GeV^2/c^2 and $0.2<x<0.87$. The experiment will use a polarized ^{3}He target. These data, combined with the soon-to-be-available precise high-x data in the DIS region from JLAB experiment E-99-117, will permit investigating quark-hadron duality in the spin structure functions of the neutron for x values below 0.65. The neutron and A_1^n data will extend up to x=0.84 (for the Δ resonance). An electron beam of 15 μA, 80% polarization will scatter on a pressurized 10 atm., polarized ^{3}He target. The expected target polarization is at least 40%.

Issues: The PAC is convinced that the neutron spin structure function g_1^n could be an important observable to study duality beyond the inclusive structure function F_2. In particular the contribution of the Δ to g_1^n is negative in an x region where the DIS g_1^n structure function is predicted to be positive. It would be highly interesting to see the transition from negative to positive values with increasing Q^2. The PAC points out that nuclear effects in ^{3}He could affect the extraction of g_1^n from ^{3}He. The PAC considers that reducing the proposed kinematics to the intermediate Q^2 values covered at E_0=3.0, 4.0 and 5.0 GeV would be sufficient to accomplish the proposed investigation.

Recommendation: Approve for 17 days in Hall A.

Individual Proposal Report

Proposal: PR-01-013

Scientific Rating: NA

Title: Testing the Limits of the Full Relativistic $(\dot{e}, e'\dot{p})$ Reaction Model.

Spokespersons: E. Brash, C. Glashausser, R. Ransome and S. Strauch

Motivation: The recoil proton polarization in $^{16}O(\dot{e}, e'\dot{p})^{15}N$ will be used to test recently developed models of the (e,e'p) reaction, especially spinor distortion, and to look for effects of nucleon modification in the nuclear medium.

Measurement and Feasibility: The polarization transfer (P'_X and P'_Z) and induced polarization P_y are measured in the Hall A focal plane polarimeter, for low values of the missing momentum and with a special emphasis on the bound $p_{1/2}$ and $p_{3/2}$ hole states in ^{16}O. The determination of a super-ratio, (P'_X/P'_Z) in oxygen divided by (P'_X/P'_Z) in hydrogen, results in very small systematic errors.

Issues: The PAC believes that the uncertainties in the treatment of the effects of final state interactions, meson exchange currents and isobar contributions, as well as the ambiguities in the current operator, make it difficult to interpret the results and to obtain information about medium effects.

Recommendation: Defer.

Individual Proposal Report

Proposal: E-01-014

Scientific Rating: B^+

Title: Precision Measurement of Electroproduction of π^0 near Threshold: A Test of Chiral QCD Dynamics.

Spokespersons: J. R. M. Annand, D. W. Higinbotham, R. Lindgren and V. Nelyubin

Motivation: π^0 production on the proton at threshold is a good testing ground for chiral perturbation theory (χ PT). Experiments with real photons have yielded results in agreement with this theory. However, inconsistencies were found in electroproduction experiments performed at MAMI. The proposed experiment would check these inconsistencies, improve and widen the overall data set, compare the results with χ PT, and provide information through a partial wave analysis.

Measurement and Feasibility: The experiment to measure the reaction $^1H(e,e'p)\pi^0$ requires the installation of the large acceptance Big Bite spectrometer. This spectrometer needs to be equipped with an improved detector system in order to match the demands of the experiment. Big Bite needs to be commissioned and calibrated. In the final installation in Hall A Big Bite will be run in coincidence with one of the HRS spectrometers and will be calibrated by means of an available Pb-glass wall, which will tag protons by elastic scattering of electrons. All components are well suited for the purpose.

Issues: Precise measurements of the electroproduction of π^0 -mesons from the proton are needed to test χ PT and to resolve discrepancies in the existing data. The PAC does not see the need to measure at Q^2 values as high as proposed and, therefore, advises skipping the setting at 4 GeV beam energy.

Recommendation: Approve for 16 days in Hall A.

Individual Proposal Report

Proposal: E-01-015

Scientific Rating: B^+

Spokespersons: W. Bertozzi, E. Piasetsky, J. Watson and S.A. Wood

Title: Studying the Internal Small Distance Structure of Nuclei via the Triple Coincidence (e,e'pN) Measurement.

Motivation: This is an update of proposal E-97-106. The goal of the experiment is to determine the ratios of (e,e'pp) and (e,e'pn) events to (e,e'p) events as a measure of short-range two-nucleon correlations in ^{12}C.

Measurements and Feasibility: Triple coincidence (e,e'pp) and (e,e'pn) events will be measured with a ^{12}C target at $Q^2 = 2$ GeV^2. The scattered electron and a forward proton will be detected in the standard Hall A spectrometers. The third arm for the protons is Big Bite, a large acceptance dipole, which must be mounted and commissioned in the Hall. Segmented scintillators will be added to a "standard" Big Bite detector package to detect protons. Neutrons will be detected in a large scintillator array to be mounted behind Big Bite, which then serves as a charged particle sweeping magnet. Almost antiparallel kinematics, $x>1$, and high Q^2 have been chosen to minimize contributions of FSI, MEC, and IC.

Issues: Determination of the relative importance of pp and pn short-range correlations was considered by the PAC as an important contribution to studies of SRC underway in many laboratories. High count rates and backgrounds, particularly in the neutron counters, make this a challenging task. Timing windows must be large to accommodate Fermi motion effects on the neutron spectrum. It is strongly suggested that these effects be modeled realistically, including the momentum distribution of the pair and the excitation energy of the residual nucleus. Extensive background measurements have been performed parasitically, but the background expected in the actual kinematics of the experiment is not yet known precisely. Approval of this experiment is thus conditional upon a realistic test of the capability of the apparatus to measure (e'pn) coincidences in the actual kinematics of the experiment with the high luminosity and signal to noise ratio needed for adequate statistics.

Recommendation: Conditionally approve for 23 days in Hall A.

Individual Proposal Report

Proposal: E-01-016

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 < 1.0 GeV/c.

Spokespersons: Seonho Choi, J.-P. Chen and Z.-E. Meziani

Motivation: The q-dependence of the integral over the energy transfer, ω, of the longitudinal response function R_L in quasi-elastic scattering from nuclei, known as the Coulomb sum rule, can yield information on nucleon-nucleon correlations and possible modifications of nucleon properties in a nucleus. Existing data for R_L do not extend beyond q=600 MeV/c and sometimes scatter widely. The goal of the proposal is to obtain a consistent and accurate data set for the nuclei ^{4}He, C, Fe and Pb, in order to get a definitive answer on the evolution of the Coulomb sum rule as a function of q up to a q-value of 1.0 GeV/c.

Measurement and Feasibility: Values for R_L are obtained by performing a Rosenbluth separation of cross sections obtained at the same value of q and ω for different values of the polarization parameter, ε. In previous experiments, most of which were done at accelerators with maximum energies below 1 GeV, the range in ε was limited and the maximum value of q was about 600 MeV/c. In the proposed experiment the range in ε will be as large as 0.85 and the data can be extended up to a value q=1.0 GeV/c. Interpolation uncertainties and uncertainties in the radiative corrections will be minimized by taking data for a well covered range in q. Data will be obtained at four ε points in order to check systematic uncertainties in the Rosenbluth separation. Different ways to treat the Coulomb corrections for the heavier nuclei lead at this moment to rather different results.

Issues: The PAC recognizes the importance of performing a definitive study of the Coulomb sum rule. The quality of the CEBAF beams and experimental equipment should allow that. In the past some data sets have been plagued by experimental backgrounds. These should be studied carefully, using all possible means. Also one should perform checks with the ^{1}H(e,e'p) reaction for every choice of kinematics. Given the increase in the anticipated (systematic) uncertainties at increasing values of q, and the expected flattening of the sum rule at high q, the PAC recommends leaving out the data at the highest q values. It is also suggested to seek close collaboration with theorists to resolve the issues involving the Coulomb distortions.

Recommendation: Approve for 26 days in Hall A.

Individual Proposal Report

Proposal: E-01-017

Scientific Rating: A^-

Title: Meson Spectroscopy in Few-Body Decays (extension request)

Spokesperson: G. Adams, C Salgado and D. P. Weygand

Motivation: This is an update of proposal E-99-005, **t**o search for exotic mesons, in particular a potential hybrid meson with $J^{PC}= 1^{-+}$, mass ~1.6 GeV/c^2, that has been reported by E852 at Brookhaven.

Measurement and Feasibility: Photoproduction of mesons decaying to three-meson final states is being measured in CLAS. These data will be used to search for new mesons with masses up to 2 GeV/c^2. Spectroscopic information on exotic mesons will be extracted from a partial-wave analysis of the data.

Preliminary analysis of data taken during the 1999 run implies that this experiment will be able to produce a partial-wave analysis with similar statistics to those obtained by E852 at BNL.

Issues: The PAC recognizes the potential importance of this experiment in establishing the existence of hybrid mesons and providing a measure of their photoproduction rates, which could have significant long-term implications for the JLab programs in this area. The PAC is concerned that a partial wave analysis that can reach the required sensitivity has not yet been demonstrated with CLAS data.

Recommendation: Approve for 6 days in Hall B.

Individual Proposal Report

Letter of Intent: LOI-01-001

Title: Study of Creation and Decay of Light η -mesic Nuclei in Photoreactions.

Spokespersons: B. Wojtsekhowski, G. Sokol , V. Baskov, A. L'vov and L. Pavlyuchenko.

Finding a new state of matter with an η bound in a nucleus would clearly be interesting. Such states have been searched for in various experiments, such as at LAMPF and the AGS, but no evidence has been found. The PAC was not convinced that the photoreactions discussed in the LOI provided significantly novel opportunities.

Individual Proposal Report

Letter of Intent: LOI-01-002

Title: Test of Time Reversal Invariance Using Electron Scattering on Polarized Protons

Spokesperson: Oscar A. Rondon

This is a letter of intent to pursue a new test of time reversal invariance in e-p scattering at JLAB. The measurements would be based on the observation of a correlation $\vec{s} \cdot (\vec{k} \times \vec{k})$ with $\vec{s}$ being the polarization of protons in a solid polarized NH_3 target, $\vec{k}$ and $\vec{k}'$ are the momenta of the incoming electron and the scattered electron detected in a large acceptance spectrometer. Measurements would be carried out at a range of Q^2 for elastic and inelastic scattering in the resonance region. Similar experiments were carried out 30 years ago at SLAC and achieved upper limits at the 1-2% level. The proponents would aim to improve these limits by a factor of 100.

Technical concerns include the very long timescale (>4 hrs) for reversing the direction of polarization of the target, meaning that the time reversal asymmetry must be obtained from a direct comparison of two absolute measurements rather than from a relative measurement as would be possible if a test were devised that made use of the very high quality polarized electron beams at CEBAF which have demonstrated very small helicity correlated beam properties. Multiphoton processes that can mimic time reversal noninvariance must be separately measured by performing the same experiments with a positron beam, which is impractical at present.

There seems to be little or no recent theoretical guidance for these measurements cited by the proponents, and the committee was skeptical that a limit on time reversal violation at the 10^{-4} level or better could be achieved based on the methods outlined in the letter. Realistic expectations of time reversal noninvariance effects are many orders of magnitude smaller than would be tested in the proposed measurements.

Given the concerns summarized above, the PAC is reluctant to encourage development of a proposal based on this letter of intent.

Individual Proposal Report

Letter of Intent: LOI-01-003

Title: Studying the Small-Distance Structure of pp and np Pairs via Triple Coincidence ^{3}He(e,e'pp) and ^{3}He(e,e'pn) Measurements.

Spokesperson: E. Piazetsky

This letter of intent is to perform further measurements of triple coincidences, (e,e'pp) and (e,e'pn), on a ^{3}He target following the measurements on ^{12}C approved in E-01-015. These measurements focus on the character of short-range correlations in the nucleus. There are clear advantages in interpreting the results in ^{3}He. This is the lightest nuclear system where both pp and pn pairs can be studied. The structure of ^{3}He can be well calculated and final state interaction effects with spectator nucleons are minimized. The kinematics are chosen to attempt to control isobar and meson exchange contributions to the reaction. The PAC believes it is unlikely that this experiment will directly measure the momentum distribution of the NN pairs. However the experiment may provide extremely valuable information on short-range correlations in the simplest system in which the difference between the pp and pn correlations can be studied. We encourage a full proposal focused on this physics.

Letter of Intent

Letter of Intent: LOI-01-004

Title: Measurement of the Parity Violating Asymmetry in the N to Delta Transition

Spokesperson: S. P. Wells and N. Simicevic

The goal of the G0 experiment, a major undertaking at JLab, is to measure the parity violating asymmetry for scattering longitudinally polarized electrons from the proton at both forward and backward angles over an extended Q^2 range. This proposed experiment, running simultaneously with G0 at backward angles, would use the inelastic channel parity violating asymmetry data for inclusive pion electroproduction from the proton through the Δ resonance to extract the axial vector transition form factor G^A_{ND} as a function of Q^2. It would be the first direct determination of this form factor in the neutral current sector of the weak interaction at low Q^2. The measurement is complementary to other approaches for obtaining information on this form factor. It is an important physics goal, which would significantly improve our knowledge of the N g Δ axial vector current matrix element.

Negative pions constitute the largest source of background for this experiment. The detector must be designed and optimized to deal with this background in a high rate environment. It is highly likely that time-of-flight alone will not be sufficient to reduce the pion contamination to the required levels. Most likely a Cerenkov detector will be required if the experiment is to achieve its stated goals.

The PAC encourages close cooperation with the G0 efforts to ensure that this experiment could be simultaneously carried out with the G0 measurements.

Appendix F

Jefferson Lab Experiments, PAC 4-19, Grouped By Category

http://www.jlab.org/exp_prog/PACpage/ExpSum.pdf