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Report of the
January 15-18, 2002
Meeting of the

Jefferson Lab
Program Advisory Committee

PAC 21

Letter from the Director

February 4, 2002

Members of the Jefferson Lab User Group

As most of you know, the Program Advisory Committee (PAC 21) met the week of January 14 at Jefferson Lab to review and rank order scientific proposals. Of the sixteen proposals reviewed by the PAC, eight were approved, three deferred and five rejected. It is gratifying to know that our user community continues to pursue the outstanding physics required to realize the scientific potential of Jefferson Lab.

Also, it was heartening to hear from the committee chair, Dr. Peter Barnes, that Jefferson Lab's scientific program is coming into its own and that he sees a breadth and range in the physics topics that just weren't envisioned earlier in the life of the laboratory.

I want to assure you that Lab Management is keenly aware of the tension between the large number of high quality physics proposals and the paucity of available running time. We continue to give this issue the highest priority and are working closely with the DOE to increase operating funding at JLab.

I want to thank the PAC 21 for their thoughtful review of the most recent proposals and for their valuable service to Jefferson Lab. I also want to thank Frank Close, James Friar and Shelley Page, who have completed their terms on the PAC, for their dedication and contribution to JLab.

Sincerely,

Christoph W. Leemann

Letter from the PAC Chair

Introduction

The Jefferson Laboratory Program Advisory Committee held its 21st meeting on January 15 - 18, 2002. 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 on sixteen proposals and four letters of intent.

General Overview

It was an outstanding meeting in terms of discussion of the new physics results that are emerging from recent JLab measurements and the introduction of new experiments proposed for the physics research program. The overall experimental program continues to proceed well. The productivity in terms of the numbers of Ph.D. theses completed (101 completed, 178 in progress) and the papers submitted for publication, continues to grow at a healthy rate, both of which indicate a very strong physics research program. In the year 2000 there were 53 publications in reviewed journals and in 2001, an additional 79 published papers and abstracts.

It is of some concern that the accelerator performance during the fall, 2001, was less productive than planned. The overall availability of the accelerator was 68% in this period compared to the goal of 77%. This is compensated to some extent by increasing availability in Halls A and B. The Laboratory management assured the PAC that it is sensitive to the impact of this reduction of accelerator availability on data collection for the physics program, and is working to improve accelerator operations.

At PAC 21 the physics scope of the proposals was very broad. It ranged from detailed nuclear physics studies e.g. on the structure and interaction currents of few-body systems and measurements of fundamental form factors, to experiments in the scaling regime and included as well, studies of fundamental electro-weak interaction physics. Several of these measurements, which require incident energies of 6 GeV, may be viewed as precursors of the future JLab program to be performed at 12 GeV.

The high demand for beam time at this meeting made the task of the PAC extremely difficult. Of the 16 proposals received, only eight experiments were approved. The PAC found it necessary to defer some attractive physics proposals which might have been approved in more normal circumstances. The PAC approved three experiments in Hall A for a total of 45 days, two experiments in Hall B for 79 days and three experiments in Hall C for 58 days (two with ratings of A, three with A^-, and three with B^+).

Recommendations

The laboratory guidelines provided for the approval of 45 days of beam time in Hall A, 72 days of beam time in Hall B, and 51 days of beam time in Hall C. These guidelines were established based on 45/45/35 days of new time to be made available in Halls A/B/C plus 50% / 100%/ 50% of the time recovered from approved experiments now required to return to the PAC due to the jeopardy process. 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 would then be deducted from the allocation of the next PAC meeting.

Overall the jeopardy process is working well. At this meeting, 59 days of approved time were under jeopardy status, 27 days in Hall B and 32 days in Hall C. The backlog in Hall A is now about 4 years, with the backlog in both Halls B and C near the goal of three years.

Among the new proposals, a major new commitment for the laboratory, recommended by the PAC, is Proposal 02-020, which after construction of a large magnet and detector system (or modification/enhancement of G0 or BLAST), anticipates a future need for about 100 days of running time in Hall C (with 23 days requested at this meeting). The proposed experiment would measure the parity-violating asymmetry in *ep* elastic scattering at Q^2=0.03 $(GeV/c)^2$. This asymmetry would be used to extract Q (weak) for the proton and has sensitivity to extensions beyond the Standard Model of Electro-Weak Interactions. The PAC is very impressed with the discovery potential of this experiment and regards it as an important addition to the Jefferson Lab program. It was given an A rating and approved for future running in Hall C.

Proposal Preparation Issues

Because of the broad spectrum of research which can be addressed by the JLab facility and the limited resources available, the proposal review process has become extremely competitive. Some of the proposals received by the PAC were excellent, with the physics arguments and technical details well worked out and the presentation characterized by both focus and clarity. On the other hand the PAC found that there were proposals with interesting and compelling physics ideas, but which were handicapped by some weakness in the preparation, which could be corrected, to the benefit of the users and JLab.

The PAC would like to call to the attention of JLab users the following considerations as they prepare their proposals:

1. **Be careful to submit a complete package that can stand alone**.
   Do not assume that the PAC is aware of information contained in previous proposals, technical notes, and letters of intent. If this information is important background for your proposal, be sure that you include it in the proposal, for example as an appendix.

2. **Give justification for the uncertainty of the final results.** Give realistic estimates of uncertainties in resolution, absolute momentum and angle calibrations, random coincidences rates, etc. and indicate how these impact the final results.
3. **Be sure to include a detailed table showing how you calculated the number of days requested**. Since run time is a very scarce resource, the PAC reviews very carefully the details of the request, makes its own calculation, and allocates the time accordingly. Therefore it is essential to give a full and detailed justification of your request.
4. **Include experimental details and simulations.** Complex and challenging experiments often require extensive justification and simulation calculations. Requests for large commitments of Laboratory resources require a more detailed justification than more straightforward projects. Discussions of yield, backgrounds, and projected statistical and systematic errors, are essential elements in the justification. To support these, it is important to give the results of simulation calculations that should be the basis of the experimental design. This is an essential component of the package required in order to get such proposals approved.
5. **Indicate how the project relates to other approved proposals**. 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. As stated in earlier PAC reports, failure to pay sufficient attention to this charge can result in the PAC not considering the new proposal until the information is provided.

The reports and PAC recommendations for the reviewed proposals and the response to the letters-of-intent are given in Appendices D and E. The tables on the following pages summarize the status of the JLab commitments from PAC 4-21.

The PAC is very appreciative of the efforts of the laboratory staff in support of the PAC meeting. The enthusiastic and thoughtful contributions of Clara Perdue, Shauna Cannella, and Susan Ewing was especially effective in making the PAC process proceed at maximum efficiency.

Peter D. Barnes
Chairman, Jefferson Laboratory Program Advisory Committee

Tables

Totals for PAC 4-21

	Experiments Recommended for Approval	Experiments Recommended for Conditional Approval	Totals
Experiments	128	6	134
Authors	922	77	999
Institutions	167	1	168
Countries	30		30

Approved Experiments Totals by Physics Topics

Topic	**Number**	**Hall A**	**Hall B**	**Hall C**
Nucleon and Meson Form Factors & Sum Rules	21	8	4	9
Few Body Nuclear Properties	26	16	5	5
Properties of Nuclei	24	6	10	8
N* and Meson Properties	40	6	27	7
Strange Quarks	17	4	11	2
TOTAL	128	40	57	31

Approved Days and Conditionally Approved Experiments

Hall	**Approved Experiments**				Conditionally Approved Experiments
	# Expts. Completed (full/partial)	Days Run	# Expts. in Queue	Days to be Run	
A	19 / 2×.5 1×.86 1x.10	414.9	13.14	341	3
B	10 / 3×.76 4×.75 4×.72 6x.61 14x.53 8x.5 3x.4	326.1	18.31	206.3	2
C	16 / 1×.5	368.5	10	161	1
Total	45 / ~26.99	1109.5	41.45	708.3	6

APPENDICES

A. PAC 21 Membership

B. Charge to PAC 21

C. PAC 21 Recommendations

D. PAC 21 Individual Proposal Reports

E. PAC 21 Letters-of-Intent

F. Approved Experiments, PACs 4–21, Grouped by Physics Category

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

Appendix A

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Appendix B

Charge to PAC 21

Jefferson Lab requests that PAC 21:

1) Review both new proposals* and extensions† or updates‡ to previously approved proposals, and provide advice on their scientific merit, technical feasibility and Recommend one of four actions on each proposal, extension or update:

   - approval,
   - conditional approval status pending clarification of special issues,
   - deferral, or
   - rejection.

   (There are two types of conditional approval: conditional pending PAC review of open scientific questions; and conditional pending Jefferson Lab management review of open technical issues. In the later case, the PAC should recommend a beam time allocation.)

2) Provide a scientific rating and recommended beam-time allocation for all proposals recommended for approval.

3) Provide comments on letters-of-intent.

4) Comment on the Hall running schedules.

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

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

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

Appendix C

PAC 21 Recommendations

Class*/Grade/Days		
A/B$^+$/5	E-02-004	A(Q) at low Q in *ed* Elastic Scattering
R	PR-02-006	Measurement of the Weak Pion-Nucleon Coupling Constant, h^1_π ,in Parity-Violating Backward Pion Photoproduction Near Threshold off the Proton (P-01-005 Update)
R	PR-02-007	Weak Production of Strangeness as a Probe of the Electron-Neutrino Mass
D	PR-02-008	Exclusive Study of Deuteron Electro-Disintegration Near Threshold
R	PR-02-009	The Neutron Electric Form Factor at Q^2=2.40 (GeV/c)^2
A/B$^+$/8	E-02-010	The $\gamma n \rightarrow \pi^- p$ Process from ^{2}H and ^{12}C, and the $\gamma p \rightarrow \pi^+ n$ Reaction
R	PR-02-011	Extracting the Electric Form Factor of the Neutron from Quasi-elastic $^3\vec{He}(\vec{e},e'n)$ Scattering at 0.1 (GeV/c)^2 <Q^2<0.4 (GeV/c)^2
A/A$^-$/50	E-02-012	Coherent Vector Meson Production off the Deuteron
A/A/32	E-02-013	Measurement of the Neutron Electric Form Factor $G_E{}^n$ at high Q^2
D	PR-02-014	Investigation of Short-Range Correlations in the ^{3}He(e,e'pp)n_{sp} Reaction at x>1 (update to E99-102 & LOI 01-103)
R	PR-02-015	A Search of Neutral Baryon Resonances Below Pion Threshold
A/B$^+$/7	E-02-017	Direct Measurement of the Lifetime of Heavy Hypernuclei at CEBAF
A/A$^-$/29	E-02-018	Photoproduction of Vector Mesons and Hyperons with a Beam of Linearly-Polarized Photons (update of CLAS g8)
A/A$^-$/28	E-02-019	Inclusive Scattering from Nuclei at x>1 and High Q^2 with a 6 GeV Beam
A/A/23	E-02-020	The Q_{Weak} Experiment: A Search for Physics at the TeV Scale via a Measurement of the Proton's Weak Charge
D	PR-02-021	Measurement of A_x and A_z asymmetries in the Quasi-elastic $^3\vec{He}(\vec{e},e'd)$ Reaction

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

Appendix D

Individual Proposal Report

Proposal: E-02-004

Scientific Rating: B $^{+}$

Title: A(*Q*) at low *Q* in *ed* Elastic Scattering

Contact Person: R. Gilman

Motivation: As model calculations of the deuteron electromagnetic form factors are being refined, a 10% discrepancy between two measurements of the elastic electron-deuteron scattering cross section between Q = 1 and 2 fm^{-1} appears to prevent reaching definite conclusions about the validity of theoretical approaches. It is proposed to perform new forward angle *ed* elastic-scattering measurements, with high precision, to settle this issue.

Measurement and Feasibility: The measurement requires an improved knowledge of the HRS spectrometer, reduced uncertainties in the scattering angle and acceptance, as well as a more precise determination of the beam intensity. These improvements seem achievable and would benefit many other experiments.

Issues: The experiment is in principle feasible at other accelerators like MAMI (Mainz) or MIT-Bates. At Jefferson Lab, the effort of this group will contribute to improve the performance of the HRS and will bring a timely answer to the physics issues.

Recommendation: Approve for 5 days in Hall A

Individual Proposal Report

Proposal: PR-02-006

Scientific Rating: N/A

Title: Measurement of the Weak Pion-Nucleon Coupling Constant, h^1_π in Parity-Violating Backward Pion Photoproduction near Threshold off the Proton

Spokespersons: R. Suleiman and S. Kowalski

Motivation: The principal goal is to determine the weak pion-nucleon coupling constant via parity violation in $\gamma + p \rightarrow n + \pi^+$ near threshold; an additional goal is to measure the asymmetry on the Δ resonance, which is estimated to be an order of magnitude larger than the value at threshold and would provide a first measurement of the weak $\gamma N\Delta$ coupling.

Measurement and Feasibility: The helicity asymmetry for backward pions near threshold is proportional to h^1_π , and is expected to be about 2×10^{-7}. The goal is to perform a measurement with 20% statistical uncertainty and negligible systematic errors. To reach this level of statistical precision, an integrating detection system is necessary. The development of a very high current polarized beam at 400 μA and 230 MeV is required to produce the bremsstrahlung photon beam that will drive the reaction of interest. These conditions will lead to very high radiation levels in the experimental hall, raising concerns about tails of the beam downstream of the radiator hitting the beam pipe on the way to the dump, thereby generating background in the pion detectors.

Issues: The physics goals of this proposal are extremely interesting, but several difficulties have not yet been addressed. The proposal asserts that the production of the photon beam will lead to no enhancement of systematic errors as compared to running conditions for parity experiments with electron beams, that all backgrounds can be adequately shielded from the apparatus, and that beam-related systematic error corrections will be at the HAPPEX II level of 1×10^{-8}. There is no evidence given to justify these assertions, which are crucial to achieving the stated precision goals of the experiment.

The PAC concludes that the amount of design and simulation effort that the collaboration has put into this proposal to date is insufficient to make the case for such a difficult experiment. There has been no serious design study for the magnet, detectors, shielding, target and beam transport that would demonstrate, at least on paper, that these very challenging measurements could be successfully carried out to the stated precision goals.

Recommendation: Reject

Individual Proposal Report

Proposal: PR-02-007

Scientific Rating: N/A

Title: Weak Production of Strangeness as a Probe of the Electron-Neutrino Mass

Spokesperson: O. K. Baker

Motivation: The goal of this experiment is to make a precise determination of the electron-neutrino mass at the eV/c^2 level by measuring a helicity-dependent asymmetry in the reaction $\vec{e} + p \rightarrow \vec{\nu} + \Lambda$ close to threshold.

Measurement and Feasibility: A 194 MeV polarized electron beam incident on a 1 cm CH_2 target would produce Λ's via the reaction of interest near threshold. The Λ particles would be reconstructed via detection of decay protons and pions in the HKS and Enge Split Pole spectrometers, respectively. The helicity asymmetry for low momentum neutrinos would be used to place limits on the neutrino mass. The PAC is convinced that the proposed measurements are not technically feasible, and in any case would not yield a significant constraint on m_ν.

Issues:

- The fundamental physical mechanism linking the rate of right-handed electron events to the value of the neutrino mass is not convincingly presented in the proposal.
- The effective target thickness used in the rate calculations does not correctly account for the very limited energy range for an electron to produce a neutrino in the momentum range of interest. Accounting for the effective target thickness would reduce the event rate by a factor of order 10^4 - 10^5 below what is stated in the proposal.
- The probability of observing an event corresponding to a non-relativistic neutrino in the lab frame in a 1 keV/c bin near $p_\nu = 0$ does not depend on the value of m_ν, but does depend on the missing momentum resolution. The implications of the momentum resolution are not correctly applied to the experimental situation.
- The momentum resolution for detecting the 2 MeV protons will be much worse than the assumed 2×10^{-4}, which applies only for much higher energy particles in the HKS. Even with the use of ultra-thin, low-pressure MWPC's, multiple scattering in the entrance foils will be on the order of tens of mrad, which will preclude accurate reconstruction of the proton tracks.
- The beam polarization of 80%, and its uncertainty, will complicate the analysis of the data. The asymmetry between + and – beam helicity states will be equal to the beam polarization. The purported signal is a very small deviation from this, and yet the beam polarization can only be measured to a

few percent accuracy. This limitation cannot be overcome in a reasonable amount of beam time by comparing asymmetries for high and low momentum neutrinos, as asserted in the proposal, because of the resolution issue noted above. In addition, a tiny polarization mismatch between + and – beam helicity states could in principle never be disentangled from the assumed neutrino mass signal.

Recommendation: Reject

Individual Proposal Report

Proposal: PR-02-008

Scientific Rating: N/A

Title: Exclusive Study of Deuteron Electrodisintegration Near Threshold

Spokespersons: K. Wang, W. Bertozzi, B. Norum, and T. Tamae

Motivation: The goal of the experiment is to study deuteron electro-disintegration near threshold and obtain high-quality data on five structure functions, which would allow for a stringent test of modern nuclear two-body models.

Measurement and Feasibility: In this exclusive measurement, electrons would be detected in the HRS and protons and deuterons in BigBite. The second HRS would serve as a luminosity monitor. The proposed measurements would span the relatively narrow Q^2 range of 10 - 14 fm^{-2} and $0 < E_{np} < 8$ MeV. The choice of Q^2 emphasizes the contributions of MEC's. Data would be obtained on all five structure functions: f_L, f_T, f_{LT}, f_{TT}, and f'_{LT}. The latter requires polarized beams and out-of-plane detection of the proton. Calibration data would be simultaneously obtained on elastic *ed* scattering.

Issues: The PAC believes that this experiment could provide high-quality data on the deuteron that could test nuclear models. The E_{np} resolution and angle calibration are crucial and must be understood and controlled carefully.

The PAC would like to see this experiment performed, but due to limitations in the available beam time the proposal cannot be accepted at this time.

Recommendation: Defer

Individual Proposal Report

Proposal: PR-02-009

Scientific Rating: N / A

Title: The Neutron Electric Form Factor at Q^2=2.40 (GeV/c)^2

Spokespersons: R. Madey and S. Kowalski

Motivation: This is an extension to higher momentum transfer of completed Hall C experiment E93-038, which determined the neutron charge form factor at Q^2=0.45, 1.15, and 1.47 (GeV/c)^2. Data at higher Q^2 would provide information on the short-distance structure of the neutron, and would be important for calculations of charge form factors of light nuclei at the same momentum transfer.

Measurement and Feasibility: A polarized electron beam of 5 GeV and a liquid deuterium target would be used in Hall C to measure the polarization of the recoiling neutron in quasi-elastic breakup of the deuteron. This technique has been shown to be sensitive to the ratio of the neutron electric and magnetic form factors, G_E^n / G_M^n, while being largely insensitive to nuclear effects, such as final-state interactions, meson-exchange currents, isobar configurations, and details of nuclear potential models. Measurements of the ratio of asymmetries for neutron polarizations oppositely precessed in the Charybdis dipole are largely independent of systematic uncertainties associated with the beam polarization and the analyzing power of the neutron polarimeter.

Issues: Measurements of G_E^n at values of Q^2 greater than 1.5 (GeV/c)^2 are very important, and the proposed measurement could be successfully performed. However, the PAC believes that the laboratory does not have enough beam time available to afford two such experiments in the same range of momentum transfer. Another proposal to measure G_E^n at this and one higher momentum transfer (PR-02-013) is deemed the better allocation of scarce resources and was approved instead of this proposal.

Recommendation: Reject

Individual Proposal Report

Proposal: E-02-010

Scientific Rating: B^{+}

Title: The $\gamma\, n \rightarrow \pi^{-}\, p$ Process from ^{2}H and ^{12}C, and the $\gamma\; p \rightarrow \pi^{-}\, n$ Reaction

Spokespersons: D. Dutta, H. Gao, and R. Holt

Motivation: The experiment is a continuation of E94-104 with a partly changed motivation. The elementary reactions $\gamma\ p \rightarrow \pi^{+}\ n$ and $\gamma\ n \rightarrow \pi^{-}\ p$ are to be investigated with narrow steps of the photon energy in order to find possible oscillations of the cross sections around the s^{-7} scaling. This is motivated by such observations in pp elastic scattering, which can be interpreted as an interference between short- and long-distance amplitudes. A further element of the proposal is to look for nuclear filtering effects by measuring the quasi-free process $\gamma\ n \rightarrow \pi^{-}\ p$ on ^{12}C.

Measurement and Feasibility: The experimental procedure is identical to that used in E94-104, which ran successfully a year ago. However, the requested number of energy settings will pose scheduling problems.

Issues: The elementary process and its scaling are of significant interest. The interference mechanism as proposed for the pp scattering cannot directly be applied to photo-production, so the question of whether oscillations occur is interesting and should be studied at JLab. The PAC recommends investigating the photo-production process on the proton and the deuteron for energies above 2.5 GeV (i.e., above the resonance region). The details of nuclear filtering depend on the nucleonic process, so the search for it should be postponed and reconsidered after the elementary cross section is well determined.

Recommendation: Approve for 8 days in Hall A

Individual Proposal Report

Proposal: PR-02-011

Scientific Rating: N/A

Title: Extracting the Electric Form Factor of the Neutron from Quasi-elastic $^3\vec{He}(\vec{e},e'n)$ Scattering at 0.1 (GeV/c)^2 < Q^2 < 0.4 (GeV/c)^2

Spokespersons: J. Gao, A. Deur, and W. Korsch

Motivation: The proposal aims at determining the electric form factor of the neutron $G_E{}^n$ for values of Q^2 from 0.1 to 0.4 (GeV/c)^2. More accurate values of $G_E{}^n$ at low Q^2 would be needed for comparison with Chiral Perturbation Theory calculations, and to reduce uncertainties in the extraction of strange form factors from parity-violation experiments.

Measurement and Feasibility: Data for the $^3\vec{He}(\vec{e},e'n)$ reaction would be taken in quasi-elastic kinematics. The Hall A polarized target would be used. The scattered electron would be detected in one of the HRS spectrometers, the other one monitoring the product of target and beam polarization through elastic scattering, while the neutron would be detected in a large scintillator array. The asymmetries $A_{//}$ and $A_{T\perp}$ for scattering of polarized electrons from the neutron in polarized ^{3}He would be determined as a function of the neutron energy, and would be compared to the results of Faddeev calculations in order to determine $G_E{}^n$.

Issues: Apart from the background in the unshielded neutron detector the experiment seems to pose no real difficulties. However, the PAC is concerned that uncertainties in the three-nucleon calculations used to extract $G_E{}^n$ will be non-negligible compared to the experimental uncertainties shown in the proposal. Furthermore, existing and upcoming data for Q^2 > 0.4 (GeV/c)^2, together with the slope of $G_E{}^n$ at Q^2 = 0, constrain $G_E{}^n$ rather well in the region 0.1 (GeV/c)^2 < Q^2 < 0.4 (GeV/c)^2 . Therefore, the PAC finds no compelling reason to perform this experiment.

Recommendation: Reject

Individual Proposal Report

Proposal: E-02-012

Scientific Rating: A$^-$

Title: Coherent Vector Meson Production off the Deuteron

Spokespersons: L. Kramer, F. Klein, and S. Stepanyan

Motivation: The goal of this experiment is to investigate coherent vector-meson production from the deuteron. It is believed that in the proposed kinematic range one would observe the onset of color transparency for color singlet $q\bar{q}$ objects.

Measurement and Feasibility: These are fully exclusive measurements near 6 GeV using CLAS. The high energy is important to improve the possibility for observing color transparency. The experiment would allow for simultaneous measurements of ρ^0, ω, and ϕ mesons. Data would be obtained over a large kinematic range: $1 < Q^2 < 4.5$ $(\mathrm{GeV/c})^2$, $0.1 < x < 0.5$ and $0.1 < -t < 1.0$ $(\mathrm{GeV/c})^2$. Deuteron detection ensures dominance of rescattering contributions, which should maximize color transparency effects. CLAS would be operated in a modified configuration: the target moved upstream and a solenoid sweeping field included. This allows higher luminosity and enhances forward acceptance.

Issues: Operation, calibration, and commissioning of CLAS will be required in the new configuration. This experiment is an important step towards the future 12 GeV program to study Generalized Parton Distributions.

Recommendation: Approve for 50 additional days in Hall B

Individual Proposal Report

Proposal: E-02-013

Scientific Rating: A

Title: Measurement of the Neutron Electric Form Factor G_E^n at high Q^2

Spokespersons: B. Wojtsekhowski, G. Cates, K. McCormick, and B. Reitz

Motivation: To probe the short-range structure of the neutron through measurements of the electric form factor G_E^n at high Q^2. These measurements will also be important for calculations of charge form factors of light nuclei at the same momentum transfer.

Measurement and Feasibility: The experiment plans to make new measurements at Q^2=2.4 and 3.4 $(GeV/c)^2$, extending the Q^2 range of precision measurements by more than a factor of two. The electric form factor will be extracted from measurements of the double spin asymmetry A_T in quasi-elastic scattering from $^3\vec{He}$. Both the electron beam and ^{3}He nuclei will be polarized. An additional measurement at Q^2=1.3 $(GeV/c)^2$ is planned to crosscheck with measurements using a deuterium target, for which nuclear corrections are expected to be smaller. Scattered electrons will be measured in the BigBite spectrometer, while neutrons will be measured in a large array of thick plastic scintillator bars. Neutrons will be separated from protons using veto counters. The experiment appears to be feasible, using standard beam and target conditions. Simulations and previous experience with BigBite and the neutron bars in other settings indicate that the proposal design goals are achievable.

Issues: The PAC was impressed by the high figure of merit for this experimental setup to measure G_E^n. The theoretical error in relating G_E^n to A_T is expected to be below the projected statistical errors, but continued efforts are needed to ensure that this is the case. Tests of the theory within the experiment will be useful (for example, checking that the proton asymmetry is as small as expected). Careful calibrations of the BigBite spectrometer will be needed at the planned high momentum setting. Tests of background rates in the neutron bars and BigBite detectors will be an important first step before final assembly of the experiment. The proton rejection capability of the neutron arm should be optimized with simulations and tested with tagged protons. The effects of protons converting in the iron shielding should be investigated.

Recommendation: Approve for 32 days in Hall A

Individual Proposal Report

Proposal: PR-02-014

Scientific Rating: N/A

Title: Investigation of Short-Range Correlations in the ^{3}He(e,e'pp)n_{sp} Reaction at x>1

Spokespersons: E. Brash, S. Gilad, D. Ireland, A. Kozlov, and E. Piasetzky

Motivation: The goal of this experiment is to investigate short-range correlations in ^{3}He in the kinematically complete two-proton knockout reaction ^{3}He(e,e′pp)n on the low-energy side of the quasi-elastic peak (x>1). The neutron would be constrained to low momenta, while the two protons would have initial momenta largely anti-parallel and parallel, respectively, to the momentum transfer, $\vec{q}$. An enhancement of the cross section for these kinematics would indicate strongly correlated protons in the ^{3}He ground state, and would provide constraints on *NN* potential models. This measurement is complementary to the approved experiment E-01-015, which will investigate *NN* correlations in ^{12}C.

Measurement and Feasibility: Measurements would be performed in Hall A using a 4.5 GeV unpolarized electron beam and a ^{3}He target that is being developed for use in conjunction with BigBite. One HRS would detect the electron at an angle of 18.1° and the other HRS the forward-going proton, while the BigBite spectrometer would detect the second proton. It is expected that this kinematics (Q^2=1.75 (GeV/c)^2; x>1) will greatly suppress competing mechanisms such as final-state interactions, meson-exchange currents, and isobar configurations.

Issues: The PAC believes that this is the appropriate type of experiment to look for the effect of short-range correlations in ^{3}He, but was not convinced that the kinematics was sufficiently optimized. Furthermore, the estimated count rates were not realistic because only pp correlations were considered. In view of recent ^{3}He(e,e′p) results from Hall A at rather similar kinematics, the argument that meson-exchange currents and final-state interactions would be unimportant in the chosen kinematics was not compelling. The PAC suggests that the proposers contact J.-M. Laget, who has performed calculations for the latter experiment. He could provide the necessary information about the two-proton spectral function and the relative importance of those reaction mechanisms that would contaminate the signal for short-range correlations. This could lead to the optimal kinematics for the proposed study of short-range correlations.

Recommendation: Defer

Individual Proposal Report

Proposal: PR-02-015

Scientific Rating: N/A

Title: A Search of Neutral Baryon Resonances Below Pion Threshold

Spokespersons: X. Jiang and R. Ransome

Motivation: This proposal would search for narrow neutral baryon resonances below the pion threshold. Such resonances have been reported in the hadronic reaction $pp \rightarrow p\pi^+X^0$. This experiment ($ep \rightarrow e\pi^+X^0$) would be sensitive to production of these states at a level of 10^{-4} of the rate of normal baryon production. The existence of such resonances would profoundly affect our understanding of hadron structure.

Measurement and Feasibility: During a one-shift test run, the collaboration set an upper limit at the level of 10^{-3} and demonstrated that this measurement is possible. At the level of 10^{-4}, a very detailed simulation of the setup would be required to understand fully all of the possible backgrounds that could give a false signal.

Issues: At Mainz, data on the reaction $\gamma p \rightarrow n\pi^+\gamma$ have already been taken. They can be analyzed in terms of the invariant mass of $n\gamma$ and $n\gamma\gamma$ systems and having a photon in the trigger makes them less sensitive to backgrounds than this proposal. The Mainz data will be analyzed before this proposal could run, and if sufficient resolution can be reached then an answer at or near the proposed level will be obtained in the near future. Furthermore, the PAC is concerned that there is no clean way to connect a null result from this *ep* experiment to the reported results in the *pp* data.

Recommendation: Reject

Individual Proposal Report

Proposal: E-02-017

Scientific Rating: B^+

Title: Direct Measurement of the Lifetime of Heavy Hypernuclei at CEBAF

Spokespersons: L. Tang and A. Margaryan

Motivation: The proposal addresses the character of the non-mesonic decay of the Λ hyperon through interaction with protons and neutrons, with partial widths Γ_p and Γ_n respectively. The strangeness-changing decay of heavy hypernuclei is dominated by this process with a lifetime $\tau = (\Gamma_n + \Gamma_p)^{-1}$. Previous attempts to measure this lifetime (about 200 ps) have suffered from poor statistics, backgrounds, and large systematic errors.

Measurement and Feasibility: The proposed technique relies on the electro-production of heavy hypernuclei in the reaction (e, e'K), followed by the delayed production of fission fragments induced by the energy released in the nuclear ΛN reaction. The detection and identification of the kaons in the SOS, the favorable bunch timing of the CEBAF beam, and the proven performance of a low pressure MWPC (LPMWPC) required for identification of the recoiling fission fragments, make this measurement appropriate and feasible at JLab.

Issues: This proposal addresses an important issue: the physics of the weak Λ N interaction**.** While this measurement does not directly address the applicability of the $\Delta I = 1/2$ rule to this process (which depends on Γ_n / Γ_p), it could provide a precise determination of the sum of the two partial widths. Careful attention to transmission of the beam through the LPMWPC, removal of the quasi-free production events from the decay sample, and control of backgrounds are critical to the success of this measurement.

Recommendation: Approve for 7 days in Hall C

Individual Proposal Report

Proposal: E-02-018

Scientific Rating: A^{-}

Title: Photoproduction of Vector Mesons and Hyperons with a Beam of Linearly-Polarized Photons

Spokespersons: P. Cole, J. Kellie, F. Klein, K. Livingston, J. Mueller, J. Sanabria and D. Tedeschi

Motivation: This proposal is the completion of the g8 experiments of Hall B. It aims at studying the baryon resonances in the mass range $1.7 < M_x < 2.0$ GeV/c^2 by using a beam of linearly polarized photons. The proposal is focused on the investigation of missing resonances that are expected to strongly couple to the ρN, πΔ, ωN and KΛ final states.

Measurement and Feasibility: CLAS provides large angular coverage and complete reconstruction of multi-particle final states with high efficiency. The self-analyzing decays of the ω and Λ will also be investigated. The use of the commissioned linearly-polarized photon beam will allow the investigation of polarization observables such as the beam asymmetry Σ and several double-spin asymmetries. These quantities are expected to be sensitive to the missing resonances. These data plus those previously taken with unpolarized and circularly polarized photons are needed as input for a partial-wave analysis that will have high sensitivity for missing baryons. The beam time requested is necessary to achieve 10% statistical uncertainties in the important ωN channel (which has a small cross section).

Issues: The PAC considers this proposal to be an important part of the experimental program devoted to the search for missing resonances. The analysis of the ωN and KΛ final states seems promising for a direct search while the separation of the ρN and πΔ final states will require a more sophisticated analysis. In all cases, a partial-wave analysis will be necessary to precisely determine the single-resonance properties. The proposed beam enhancements will significantly improve the photon beam quality. The coherent-bremsstrahlung technique is an important part of the 12 GeV upgrade.

Recommendation: Approve for 29 days in Hall B

Individual Proposal Report

Proposal: E-02-019

Scientific Rating: A$^-$

Title: Inclusive Scattering from Nuclei at $x > 1$ and High Q^2 with a 6 GeV Beam

Spokespersons: A. Lung, J. Arrington, D. Day, and B. Filippone

Motivation: The aim of the measurement is to take data in an unexplored kinematic region. The values of x are high and the momentum transfer is large enough that scaling will be reached. The inclusive nature of the process simplifies the relation between the measured quantities and the nuclear wave functions when scaling is manifest. These new data have been long awaited and are essential in order to understand the nucleon degrees of freedom in the scaling region. Studies of the deuteron are necessary because one often considers the ratio of nuclear to deuteron cross sections as a measure of effects of the medium. The helium nuclei are necessary because good calculations of wave functions can be tested. Heavier nuclear targets are necessary because the ratio of surface to volume effects decreases with A.

Measurement and Feasibility: This experiment will measure inclusive electron scattering from a wide range of nuclear targets, using an electron beam with energy close to 6 GeV, and scattering at angles of 20 to 60 degrees**.** These measurements seem straightforward, and this group has run a similar experiment at 4 GeV.

Issues: The PAC believes that this is an important measurement.

Recommendation: Approve for 28 days in Hall C

Individual Proposal Report

Proposal: E-02-020

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

Contact person: R. Carlini

Motivation: To search for physics beyond the Standard Model at the TeV scale via a measurement of the proton's weak charge.

Measurement and Feasibility: The experiment would measure the parity-violating asymmetry in *ep* elastic scattering at Q^2=0.03 $(GeV/c)^2$, using a beam of longitudinally polarized electrons with energy near 1.2 GeV, scattering from an unpolarized liquid hydrogen target at angles near 9 degrees. A new toroidal magnet would be used to focus elastically scattered electrons onto quartz detectors, operating in current mode. Inelastic scattering would be separated from elastic scattering through the magnet optics, combined with carefully designed collimators. The expected experimental asymmetry is very small (0.23 ppm), implying the need for a long running time, high beam current, a high power target, and very good control of helicity-correlated beam conditions. The beam polarization would be monitored continuously. The measured asymmetry would be used to extract Q(weak) using measured quantities and an extrapolation to lower values of Q^2. The value of 0.03 $(GeV/c)^2$ appears to have been well chosen for minimizing the errors due to hadronic uncertainties while maximizing the asymmetry.

The experiment appears to be feasible as proposed, and will be very challenging. The plan of simulations, detailed design, and experimental tests outlined by the proponents seems reasonable and prudent, but given the history of parity violation experiments, unexpected difficulties could arise.

This proposal requests 23 days for an initial run to obtain an 8% relative statistical error. A longer run will be requested upon successful demonstration of the experimental capabilities, with the ultimate goal of a 4% relative error. This level of precision is required to make a competitive search for physics beyond the Standard Model.

Issues: The PAC is very enthusiastic about the discovery potential of this experiment, and regards it as an important addition to the Jefferson Lab program. The large impact on laboratory resources is well justified. This will be a very difficult experiment, which requires a large magnet and detection system either as new construction or modification/enhancement of G0 or BLAST. This measurement pushes the parameters of approved parity violation experiments at Jefferson Lab. These include the high power in the liquid hydrogen target, the high current in the detectors, the difficulty of reducing backgrounds in an integrating detector in an open geometry magnet to acceptable levels, the small beam charge asymmetry required, and the high demands on detector linearity, to name a few. These issues should be addressed by continued simulations and experimental tests, and careful review of the project by experts in the field.

Recommendation: Approve for 23 days in Hall C

Individual Proposal Report

Proposal: PR-02-021

Scientific Rating: N/A

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

Spokespersons: Z.-L. Zhou, W. Bertozzi, D. Higinbotham, B. Norum, and S. Sirca

Motivation: The proposal aims at testing modern Faddeev calculations with emphasis on the S' and D states of ^3He. Such calculations are needed for the interpretation of experiments such as Deep-Inelastic Scattering and neutron form-factor measurements that use polarized ^3He as a polarized neutron target.

Measurement and Feasibility: The double-polarization asymmetries A_x and A_z in the $^3\vec{H}e(\vec{e},e'd)$ reaction would be determined in both parallel and perpendicular kinematics for a range of recoil momentum. A value of 620 MeV/c is chosen for the three-momentum transfer, large enough that the produced deuterons suffer small energy loss in the target, and still within the range where relativistic effects in the Faddeev calculations are not too large. The experiment would use the Hall A polarized target, one of the HRS spectrometers for the detection of the scattered electron, the other one monitoring the product of target and beam polarization, and the BigBite spectrometer for the detection of the deuteron. Due to the relatively high luminosity of this set-up in combination with a large virtual photon flux, the count rates would be large enough to determine the small asymmetries with good accuracy. The A_x and A_z asymmetries in the two kinematics show a different sensitivity to ingredients of the calculations such as the S' and D states, meson-exchange currents, and Delta-isobar currents.

Issues: It was noted that no time was asked for tests and calibrations, e.g., of the absolute angle of BigBite. By also using the data with the angle between the momentum transfer and the recoil momentum between 30 and 60 degrees, the PAC thinks that the goals of the proposal could be reached with less beam time.

The PAC would like to see this experiment performed, but due to limitations in the available beam time the proposal cannot be accepted at this time.

Recommendation: Defer

Appendix E

Individual Letter of Intent Report

Letter of Intent: LOI-02-001

Title: Meson Spectroscopy at CLAS

Contact Person: C. Salgado

This letter of intent discusses an extension to experiments E99-005 and E01-017, which study the photo-production of mesons in the 1-2 GeV/c^2 mass range using the CLAS spectrometer. The previous two experiments have focused on the $3\pi N$, K^+K^-p and $K^+K^-\pi N$ final states. Invariant-mass spectra produced from between 10% and 20% of the already collected data, hint at a rich resonance structure in the 3π system. There appears to be sufficient statistics to carry out a good partial-wave analysis assuming that the backgrounds and the detector acceptances are well understood. Data are also presented on final states involving K^+K^- pairs, but with much lower statistics. These results look encouraging.

The PAC recognizes the potential importance of establishing hybrid mesons and providing a measure of their photo-production rates. The PAC continues to be concerned that a partial-wave analysis that can reach the required sensitivity has not yet been demonstrated with CLAS data. The presented plots clearly indicate that it will take some effort to understand the acceptance of CLAS for the existing data. This understanding is crucial for a good analysis. A compelling physics case to extend this program will require the successful completion of a partial-wave analysis of the existing data.

Individual Letter of Intent Report

Letter of Intent: LOI-02-002

Title: Testing GPDs in Hard Exclusive Electroproduction of Neutral Pseudoscalar Mesons

Contact Persons: H. Avakian and V. Koubarovski

The physics of the proposed reactions is interesting, but is probably more complicated than the leading-order picture presented. A full proposal should elaborate on the interpretability of the experiment in view of effects such as higher-twist diagrams and final-state interactions. The compatibility of the proton running with the already approved DVCS experiment makes for a logical addition to that run period. The overall efficiency of the CLAS program would be increased if the proposed deuteron running could be done simultaneously with other experiments.

Individual Letter of Intent Report

Letter of Intent: LOI-02-003

Title: Helicity Structure of the Pion Production on Polarized Deuteron and the GDH Sum Rule for the Neutron

Contact Person: J.-P. Chen

The experiment would measure the helicity 1/2 and 3/2 partial and total photo-production cross sections on polarized deuteron, up to E_γ = 2.2 GeV (as stated in PR-94-117). In the meantime, some data have been taken at Mainz and more will be taken starting in 2003 (E_γ < 800 MeV). Bonn has the potential of measuring up to 3 GeV.

The PAC views this physics as interesting, independent of the kind of polarized target to be used.

The LOI proposes to use an HD target, which has been developed by the LEGS collaboration (BNL), who have recently managed to demonstrate the functioning of this target in beam. However, except for one figure, no information on the performance of the target has been made available to the PAC.

The PAC encourages an updated proposal when successful operation of an appropriate polarized target at JLab is demonstrated.

Individual Letter of Intent Report

Letter of Intent: LOI-02-004

Title: Incoherent ρ^0 Electroproduction on Nuclei at 6 GeV

Contact Person: K. Hafidi

The intent is to measure the Q^2 dependence of the nuclear transparency ratio, $T_A = \sigma_A/(A\sigma_N)$, in the incoherent diffractive ρ^0 electroproduction. The measurement would be performed on carbon and copper for fixed coherence lengths $l_c = 0.5$ and 1.2 fm. Similar experiments at Fermilab (E665) and HERA (HERMES) showed signals that could be related to color transparency (CT). A measurement at 6 GeV with CLAS would provide better statistics and resolution. The exclusive diffractive ρ^0 production can be selected by using appropriate kinematical cuts. The results of a preliminary analysis of the CLAS data on carbon at lower energies look promising.

CEBAF will certainly provide high quality data. However, the influence of baryon resonances and the relatively low value of the transferred energy would require good theoretical support to interpret the results in the frame of CT.

The proponents should include deuterium as a target. They should also show that the detection of the incoherent diffractive production in nuclei is feasible.

The PAC encourages the submission of a full proposal.

Appendix F

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